MIT | Academy of Engineering

(An Empowered Autonomous Institute Affiliated to Savitribai Phule Pune University)

**(Off Campus)**

# DETAILED PROJECT REPORT (DPR)

## Bachelor of Technology in

- Computer Engineering
- Information Technology
- Electronics and Telecommunication Engineering
- Artificial intelligence

**(Off Campus)**
**Academic Year 2026-2027**
**MIT Academy of Engineering, Alandi (D), Pune**

# 1. **Preamble**

## a. Introduction

The proposed undergraduate programs in Computer Engineering, Information Technology, Electronics and Telecommunication Engineering, and Artificial Intelligence are strategically designed to develop a future-ready workforce with strong technical expertise and interdisciplinary competencies. These programs aim to meet the increasing industry demand for professionals capable of innovating, designing, and implementing cutting-edge solutions in the context of Industry 4.0, digital transformation, and intelligent systems. By offering these programs at the off-campus center, MIT Academy of Engineering seeks to extend its academic excellence and contribute to shaping skilled engineers who can thrive in a rapidly evolving technological landscape.

- **Computer Engineering** focuses on integrating core computer science principles with advanced software engineering practices to design and deploy scalable, secure, and high-performance applications. Students will gain expertise in software architecture, full-stack development, DevOps, cloud-native solutions, cybersecurity, and modern programming paradigms. The curriculum emphasizes emerging technologies such as **Microservices Architecture, Kubernetes, Blockchain Development, Serverless Computing, Progressive Web Apps, and CI/CD pipelines**.
- **Information Technology** emphasizes the management and optimization of information systems, enterprise IT infrastructure, and digital platforms. Students will learn about **network administration, cloud services, database systems, IT security, enterprise resource planning (ERP), and data analytics**, preparing them for roles in IT consulting, system integration, and digital service delivery.
- **Electronics and Telecommunication Engineering** bridges hardware and communication technologies, focusing on **embedded systems, VLSI design, wireless communication, IoT, 5G networks, and signal processing**. The program equips students to design and implement advanced electronic circuits, communication protocols, and smart devices that power modern connectivity solutions.
- **Artificial Intelligence** is at the forefront of technological innovation, enabling machines to learn, reason, and make decisions. This program covers **machine learning, deep learning, natural language processing, computer vision, robotics, and AI ethics**, preparing graduates to develop intelligent systems for applications in healthcare, finance, autonomous systems, and smart cities.

Together, these programs provide a holistic approach to technology education, fostering innovation and entrepreneurship while aligning with national initiatives such as **Digital India, Atmanirbhar Bharat, and Startup India**.

**Importance of These Programs:**

The convergence of **Computer Engineering, IT, Electronics & Telecommunication, and AI** drives India's digital economy and global competitiveness. These disciplines collectively address critical industry needs in **cloud migration, application modernization, cybersecurity, intelligent automation, and next-generation communication systems**. With India's IT and electronics market projected to exceed $400 billion by 2026, graduates from

these programs will play a pivotal role in building **enterprise-grade applications, AI-driven platforms, IoT ecosystems, and 5G-enabled solutions**.

These programs support:

- **Digital India** through e-Governance and digital infrastructure.
- **Atmanirbhar Bharat** by promoting indigenous product development.
- **Startup India** by fostering innovation in AI, IoT, and software solutions.

Graduates from these programs enjoy excellent career prospects, with placement rates exceeding 90% and starting salaries ranging from ₹8–18 LPA in top companies such as **TCS, Infosys, Accenture, Qualcomm, NVIDIA, Zoho, and AI-focused startups**.

**Applications across Industries:**

The combined impact of these programs spans multiple sectors:

- **Enterprise Solutions**: ERP/CRM systems, SaaS platforms, supply chain optimization.
- **Fintech**: AI-driven fraud detection, blockchain wallets, algorithmic trading.
- **Healthcare**: Telemedicine platforms, AI diagnostics, IoT-enabled health monitoring.
- **Telecommunication**: 5G networks, IoT connectivity, smart communication systems.
- **E-commerce**: Full-stack marketplaces, recommendation engines, secure payment systems.
- **Smart Cities**: Intelligent traffic systems, IoT-based utilities, surveillance solutions.
- **Education**: Adaptive learning platforms, VR/AR-based training modules.
- **Entertainment & Gaming**: AR/VR applications, AI-driven content personalization.
- **Industrial Automation**: Robotics, predictive maintenance, AI-powered manufacturing.

**b. Background of the Consultants**

The institute has independently prepared this Detailed Project Report without engaging any external consultants or third-party advisory services.

**c. Technical Education and Industry Scenario**

Maharashtra is one of India's leading hubs for technical education, hosting over **1,500 engineering colleges** affiliated with prominent universities such as **Savitribai Phule Pune University (SPPU)**. Collectively, these institutions offer approximately **5.5 lakh undergraduate engineering seats annually** through the **MHT-CET entrance examination**, which attracted **4.2 lakh candidates in 2025**. Among these programs, **Computer Engineering** continues to dominate with nearly **1.2 lakh seats (22% share)**. However, specialized tracks in **software development, advanced IT systems, electronics & telecommunication technologies, and artificial intelligence** remain limited, creating a significant gap between industry requirements and academic offerings.

**Key Statistics (CET Cell 2025-26)**

| Category | Seats Available | Fill Rate | Closing Rank (Percentile) |
|---|---|---|---|
| Computer Engineering (General) | 1,10,000 | 92% | 85th percentile |
| Software Development Focus | 4,200 | 95% | 92nd percentile |

| | | | |
|---|---|---|---|
| Full-Stack & DevOps Tracks | 1,800 | 98% | Top 8% performers |
| AI & Data Science Specializations | 2,500 | 97% | Top 10% performers |
| Electronics & Telecommunication Core | 35,000 | 90% | 80th percentile |

**Educational Gaps**:

- Only **40% of graduates** possess advanced skills in **microservices, Kubernetes, CI/CD pipelines, and cloud-native development**.
- Industry **internships** of six months or more are mandatory in **just 15% of programs**, limiting practical exposure.
- Global **certifications** (AWS, Azure, Google Cloud, AI/ML) are integrated into **less than 10% of curricula**.
- AI **and IoT integration** in electronics programs is minimal, despite growing demand for smart devices and automation.

**Industry Scenario**

Maharashtra's **IT and IT-enabled services (ITeS) sector** contributes significantly to India's digital economy, generating **US$40 billion in annual exports** (18% of the national share) and employing **4.5 million professionals**. Pune, as a major technology hub, boasts the **Hinjewadi-Magarpatta corridor**, which hosts **1,200+ IT firms** and drives **25,000 annual software and technology hires**. Emerging domains such as **AI-driven solutions, IoT ecosystems, 5G communication systems, and cloud architecture** are fueling demand for highly skilled engineers.

**Table: Demand-Supply Matrix**

| Role Category | Annual Demand | Current Supply | Skill Gap | Avg. Package (LPA) |
|---|---|---|---|---|
| Full-Stack Developers | 45,000 | 28,000 | 38% | ₹12–18 |
| DevOps Engineers | 18,000 | 9,000 | 50% | ₹15–22 |
| Cloud Architects | 12,000 | 5,500 | 54% | ₹18–25 |
| Software Architects | 8,000 | 3,200 | 60% | ₹20–30 |
| AI/ML Specialists | 20,000 | 8,500 | 57% | ₹18–28 |
| IoT & Embedded Engineers | 15,000 | 7,000 | 53% | ₹10–16 |

**Major Recruiters in Pune**:

- Service **Giants**: TCS (15,000 hires), Infosys (12,000), Wipro (10,000)
- Product **Companies**: Zoho, Freshworks, Postman (5,000 roles)
- Fintech **Leaders**: PhonePe, Razorpay, PayU (4,000 developers)
- AI **& Cloud Innovators**: NVIDIA, Google Cloud, AWS partners

**Growth Drivers**:

- Magnetic **Maharashtra 2.0**: ₹1.13 lakh crore investments, creating **2.5 lakh jobs** in technology sectors.
- IT **Policy 2023**: 20% subsidy for establishing **software training and AI innovation centers**.
- Digital **Maharashtra Initiative**: Cloud migration mandates and AI adoption projected to create **30,000+ roles** in the next three years.
- 5**G Rollout & IoT Expansion**: Driving demand for electronics and telecommunication engineers with AI integration.

## 2. The Promoting Body

### a. Introduction to its Genesis including its Registration Status Details of its Promoters including their Background

Society Registration Act 1860 – Bombay Public Trust Act 1950

| | **Society** | **Trust** |
|---|---|---|
| **Registration Number** | Maharashtra / 1394 / Pune /83 | F –2555 |
| **Date of Registration** | June 21st 1983 | October 24th 1983 |
| **Place of Registration** | Pune | Pune |

### b. Details of its Promoters including their Background

**Dr. Vishwanath D. Karad**

Prof. Karad is widely recognized as an eminent educationist, a distinguished teacher of repute, and a passionate ambassador for world peace. He exemplifies a true multidimensional personality, actively engaged in diverse initiatives spanning education, social and cultural development, environmental sustainability, research and innovation, peace studies, human rights education, village development, mass education, healthcare, and religious harmony. His pioneering efforts also encompass nation-building programs founded on innovative concepts. A man of high principles and unwavering commitment, Prof. Karad strives to promote moral and ethical family values, fostering harmony and peace within global society. His dedication to these ideals was evident during his participation at the **Parliament of the World's Religions** held at the Salt Palace Convention Center, Salt Lake City, Utah (USA), where over 10,000 delegates from more than 80 nations and 50 faiths gathered to work collectively for a world rooted in compassion, peace, justice, and mutual understanding.

**Key Leadership Roles and Contributions:**

Founder President & Director General, **World Peace Centre (Alandi), MAEER's MIT, Pune, India.**

UNESCO Chair Holder & Regional Coordinator for Asia-Pacific Region, **UNESCO Chair for Human Rights, Democracy, Peace & Tolerance.**

Founder & Executive President, **Shree Kshetra Alandi-Dehu Parisar Vikas Samiti**, Pune.

Founder & Executive President, **Saint Shree Dnyaneshwara and Saint Shree Tukaram Endowment Lecture Series Trust**, Pune.

Founder & Executive President, **World Peace Research Foundation**, Pune, India.

Prof. Karad's lifelong mission continues to inspire global efforts toward peace, justice, and sustainable development.

**Prof. Prakash Bhaskar Joshi**

Born on November 10, 1938, Prof. Prakash Bhaskar Joshi graduated in Engineering with distinction and later earned his Master's degree in Mechanical Engineering in 1967. With a deep passion for teaching, he devoted his career to the noble cause of engineering education. A significant part of his professional life was dedicated to teaching Mechanical Engineering subjects at the Government College of Engineering. Prof. Joshi played a pivotal role in the establishment of MAEER's MIT Engineering College, Pune. In 1983, he undertook the challenging responsibility of managing and coordinating the initial activities required to set up MIT—the first private unaided engineering college in Pune—providing unwavering support and leadership during its formative years.

**Prof. Dr. Rahul Karad**

Rahul Vishwanath Karad serves as the **Executive President of MIT World Peace University, Pune**. An engineering graduate and management postgraduate from **Cardiff, UK**, Rahul is also an alumnus of the prestigious **Harvard Business School, USA**. Carrying forward the visionary mission of his father, **Prof. Dr. Vishwanath Karad**, Founder of the MIT Group of Institutions, Rahul leads with fearless passion and a deep sense of patriotism. He firmly believes in harnessing the power of youth to strengthen their active participation in India's pluralistic democracy. His unwavering nationalistic spirit finds expression through numerous initiatives aimed at inspiring young minds, instilling pride, and fostering a renewed sense of patriotism among the next generation of leaders.

**Prof. Dr. Mangesh Karad**

Dr. Mangesh Karad currently serves as the **Executive Director and Secretary of MAEER's MIT Group of Institutions**, which has established collaborations with several internationally reputed universities and institutes. Within a decade, he has transformed MIT into a premier technical education hub, spread across **125 acres of lush, green campus**, and pioneered numerous innovative initiatives. Among these is the **Mol Mitsui Simulation Centre** for Marine Engineering students—an architectural marvel designed as a ship, modeled from an actual decommissioned vessel sourced from Alang and installed at Loni Kalbhor.

Under his leadership, Dr. Karad has developed a **Business Incubation Centre**, fostered a vibrant culture of extracurricular activities, and created a dedicated cell to attract and integrate international students from emerging economies such as **Africa, Tanzania, Nepal, and Tibet**. His rise to this position is a testament to his unwavering dedication, meticulous approach, and relentless pursuit of perfection. Dr. Karad personally oversees every developmental initiative at MIT, ensuring excellence at every stage. A dynamic and visionary educationist, Dr. Karad combines academic rigor with innovative thinking. His "out-of-the-box" strategies have driven MIT's massive expansion and elevated its reputation as a group of institutions delivering **unparalleled academic excellence**. He has been instrumental in establishing unique colleges, including the **Maharashtra Academy of Naval Education & Training (MANET)**, which provides specialized engineering education for the maritime industry. Leveraging his extensive network and research-driven approach, he has introduced customized programs aligned with global employment trends and industry needs. Committed to making MIT the **preferred destination for technical education**, Dr. Karad founded the **MIT University of Art, Design and Technology**, now ranked among the top private state universities in Maharashtra. He firmly believes that the greatest challenge facing Indian academia is the creation of world-class infrastructure to stem brain drain and compete with Ivy League institutions globally. For him, **innovation is the cornerstone of quality education**. A strong advocate of lifelong learning, Dr. Karad emphasizes that the true purpose of education is not merely to confer degrees but to **nurture global leaders and statesmen** who lead with integrity. His mission is to equip MIT students with life skills, cutting-edge resources, and advanced technology tools, empowering them to excel in any field they choose. Above all, Dr. Karad aspires to raise the bar for education in India. As an educationist with vast experience and as Trustee and Secretary of MAEER, he is

committed to making MIT a pioneer in **quality-driven, practice-oriented, application-focused, and technology-enabled learning**.

**Shri. Tulsiram Dadarao Karad**

He is a progressive farmer and a respected leader in his native village, **Rameshwar (Rui), Taluka Latur**, as well as in the surrounding villages. Coming from a family with a highly esteemed cultural heritage, he is deeply rooted in the **Varkari Sampradaya**, a tradition devoted to **Shri Vitthal** and inspired by the teachings of revered saints **Shri Dnyaneshwar Maharaj** and **Shri Tukaram Maharaj** of Maharashtra. He is passionate about devotional music and actively participates in **Bhajan programs** and other spiritual activities within the community. In addition to his cultural and spiritual contributions, he has held key responsibilities as an **Office Bearer of the Village Panchayat** and oversees the functioning of schools managed by **MAEER, Pune**, in Rameshwar and Latur, ensuring quality education and community development.

**Dr. Suchitra Umesh Nagare**

**Joint Managing Trustee & Treasurer, MAEER – Pune.** Dr. Suchitra Umesh Nagare holds the dual roles of **Joint Managing Trustee and Treasurer** at MAEER's board in Pune, reflecting significant responsibilities in the strategic, financial, and operational management of the organization.

**Prof. Dr. Sunil Karad**

As the **Executive Director, Treasurer, and Trustee of the MIT Group of Institutions**, Dr. Sunil Karad has played a pivotal role in establishing several landmark institutions, including **MIT Institute of Design**, **MIT Academy of Engineering**, and **Vishwashanti Gurukul World School**, among others. His visionary leadership extends beyond traditional education—he is the **Founder of EDUGILD**, a global EdTech startup accelerator that provides a vital platform for innovative ideas aimed at transforming the education technology sector. Dr. Sunil Karad also served as the **Chief Convener of ABU Robocon India**, fostering creativity and technical excellence among engineering students nationwide. Academically, he holds an **M.Sc. in Material Science** and earned his **Ph.D. from the University of Sheffield, UK**. His research contributions have been widely recognized, earning numerous awards and citations in reputed international journals. Committed to continuous learning, Sunil has participated in professional development

programs at prestigious institutions such as **London Business School** and the **Indian School of Business**, further strengthening his expertise in leadership and strategic management.

**Smt. Kamal B. Avhad**

Smt Avhad is a Member Trustee of Maharashtra Academy of Engineering & Educational Research (MAEER), Pune. She is also associated with Ajanta Foams Pvt. Ltd. as a director and actively supports the institution's governance and development initiatives.

**Dr. Virendra Suresh Ghaisas**

He is **Member Trustee, MAEERs, MIT Group of Institutions, Pune** and is a renowned ENT (Ear, Nose & Throat) specialist and surgeon based in Pune, with over two decades of experience. He holds an **MBBS** (Shivaji University, 1997) and an **MS in ENT** (Shivaji University – JNMC, Belgaum, 2001)

**Adv. Avinash B. Avhad**

Adv. Avinash B. Avhad serves as a Member Trustee of the Maharashtra Academy of Engineering & Educational Research (MAEER), Pune, where he contributes legal expertise to institutional governance and strategy. Based in Kothrud, Pune, he is a practicing advocate with extensive experience in civil and appellate litigation, and also holds a directorship at Ajanta Foams Pvt. Ltd.

**Prof. Swati Mukund Chate**

**Member Trustee, MAEER's MIT Group of Institutions, Pune.** Prof. Swati Chate, an alumna and engineering postgraduate from MAEER's MIT College, has been a pivotal member of the Executive Board since 2006, serving as Trustee and Secretary General.

**Prof. Jyoti Avinash Dhakne**

A *Member Trustee, MAEER – Pune.* Prof. Jyoti Avinash Dhakne serves on the Board of Trustees at MAEER, Pune, contributing significantly to the governance and strategic direction of the institution.

**Dr. Aditi Rahul Karad**

A *Member Trustee, MAEER's MIT Group of Institutions, Pune.* Dr. Aditi Karad holds the position of **Member Trustee and Joint Secretary General** for the MAEER's MIT Group of Institutions in Pune, contributing strategically to its governance and institutional development.

**Mrs. Vidya Prakash Joshi**

A *Member Trustee, MAEER, Pune,. M*rs. Vidya Prakash Joshi serves as a dedicated **Member Trustee** on the Board of MAEER, Pune, contributing significantly to the strategic leadership and governance of MAEER's diverse educational ventures.

**Shri. Vinayak Suresh Ghaisas**

**A Member Trustee, MAEER – Pune.** Shri Vinayak S. Ghaisas plays a key role in the governance of MAEER as a **Member Trustee**, contributing strategic vision and leadership to the institution's growth, which now encompasses five universities and over 70 institutes.

**Shri. Ramesh Kashiram Karad**

A *Co-opted Member Trustee, MAEER – Pune.* Shri Ramesh Kashiram Karad, commonly known as Ramesh Appa Karad, currently serves both as a **Member of the Maharashtra Legislative Council** and a **Co-opted Member Trustee** of MAEER, Pune.

**Mrs. Pornima Nagargoje**

Mrs. Nagargoje is Co-opted member trustee of MAEER, Pune.

**Dr. Hanumant T. Karad**

Dr. Hanumant T. Karad serves as a Co-opted Member Trustee of MAEER, bringing to the role his extensive expertise as an eminent eye surgeon, educationist, and Executive Director of several MAEER institutions in Latur. He also leads Netrapratishthan's Eye Bank and D. S. Karad Eye Institute, underlining his deep commitment to healthcare, academic excellence, and community service.

**Mrs. Devika Ghaisas**

Mrs. Ghaisas is a co-opted member trustee of MAEER, Pune.

**c. Activities of the Promoting Body including a listing of major educational promotion activities undertaken by it in the past.**

The **Maharashtra Academy of Engineering and Educational Research (MAEER), Pune** was established in **June 1983** with the vision of educating and training young, deserving students in engineering and technology. Since its inception, MAEER has consistently worked toward societal betterment through a **value-based education system**. Today, with over **30,000 students across diverse disciplines**, the MIT Group of Institutions under MAEER has emerged as a leading educational conglomerate, reflecting excellence in **Engineering, Medicine, Management, Research, Primary and Secondary Education, Peace Studies, Environmental Sustainability, and Human Values**, while striving toward the ultimate goal of **World Peace**.

**Major Educational Initiatives and Institutions Established**

MAEER has successfully promoted and established a wide range of institutions across multiple domains, including:

Universities

1. **MIT World Peace University, Pune:** Offering programs in Engineering (B.Tech), Design (B.Des), Education (B.Ed), Business Administration (BBA), Fine Arts, Media & Journalism, Pharmacy, Commerce, Economics, Computer Science, and Management.
2. **Avantika University, Ujjain (MP):** Schools of Design, Business, Engineering, and Architecture.
3. **MIT Art, Design & Technology University, Pune:** Includes Schools of Engineering, Fine Arts, Bioengineering Sciences, Film & Television, Vedic Sciences, Naval Education & Training, Food Technology, and Management.
4. **MIT University, Meghalaya:** Specialized programs in Hospitality, Tourism, Finance, Retail, Cloud Computing, and Oil & Gas Informatics.

Engineering & Technology Institutes

- MIT Academy of Engineering (MITAOE), Pune
- MIT College of Food Technology, Pune
- MIT School of Advanced Science & IT, Pune
- MIT College of Railway Engineering & Research, Barshi

Medical Institutes

- Maharashtra Institute of Medical Sciences & Research (MIMSR), Latur
- Maharashtra Institute of Medical Education & Research (MIMER), Talegaon
- Maharashtra Institute of Dental Science & Research (MIDSR), Latur
- Colleges of Nursing, Physiotherapy, and Allied Health Sciences

Faculty of Education

- Multiple B.Ed. and D.Ed. Colleges across Maharashtra

Schools & Junior Colleges

- MIT Vishwashanti Gurukul Schools

- MIT Junior Colleges (Science, Commerce, Arts)
- Primary and Secondary Schools in Pune, Latur, Beed, Aurangabad, Solapur, and Ahmednagar

Other Institutes

- MIT College of Science & Computer Studies
- **World Peace Center**, UNESCO Chair for Human Rights, Democracy, Peace & Tolerance

**d. Mission of the Promoting Body**

To harness the knowledge of Science & Technology for the welfare of the society.

**e. Vision of the Promoting Body**

To promote the "Culture of Peace" through value based "Universal Education System", with a firm belief that "Union of Science and Religion / Spirituality alone will bring peace to mankind".

**3. Objectives and Scope of the Proposed Institution**

**MIT Academy of Engineering** aspires to be a center of excellence in technical education by introducing cutting-edge undergraduate programs in **Computer Engineering, Information Technology, Electronics & Telecommunication Engineering, and Artificial Intelligence**. These programs are strategically designed to produce **industry-ready professionals** who can drive innovation and contribute to India's vision of becoming a global technology leader.

**Key Objectives:**

- **Deliver Holistic Education**: Blend foundational engineering principles with advanced domain-specific knowledge in **software development, IT infrastructure, communication systems, and AI technologies**, ensuring graduates are equipped for **90%+ placement outcomes** in high-growth sectors.
- **Create Innovation Ecosystems:** Establish platforms for **hackathons, open-source contributions, AI-driven projects, IoT prototypes, and startup incubation**, fostering entrepreneurship aligned with **Atmanirbhar Bharat** and **Digital India** initiatives.
- **Develop T-Shaped Professionals:** Cultivate graduates with **deep expertise in their core discipline** (e.g., full-stack development, cloud architecture, 5G communication, machine learning) and **broad capabilities in digital transformation, cybersecurity, and data analytics**.
- **Foster Research and Intellectual Property:** Promote a strong research culture targeting **20+ publications and 5 patents annually** through student-led projects in areas such as **AI applications, IoT systems, VLSI design, and cloud-native solutions**.
- **Strengthen Industry-Academia Collaboration:** Partner with leading **IT firms, telecom companies, and AI solution providers** for **curriculum co-design, global certifications (AWS, Azure, AI/ML), and mandatory 6-month internships**, ensuring real-world exposure and skill relevance.

- **Support Emerging Technologies and National Priorities:** Align programs with **Industry 4.0, 5G rollout, IoT adoption, and AI-driven automation**, contributing to India's projected **$350 billion digital economy by 2030**.

### a. General and Technical Education Scenario of the State

Maharashtra stands as a leading state in India's technical education landscape, hosting **1,500+ engineering colleges** that collectively offer **over 5.5 lakh undergraduate seats annually** through competitive examinations such as **MHT-CET and JEE Main**. The state demonstrates a strong commitment to education by allocating **₹74,830 crore (17.2% of its annual budget)**—a figure significantly higher than the national average—towards initiatives that support **Digital Maharashtra, Skill India, and Industry 4.0 adoption**.

**Current Engineering Education Landscape**

- **Total UG Engineering Seats**: 5,50,000+
- **Computer Engineering Seats**: 1,20,000 (22% of total)
- **Information Technology Seats**: ~45,000 (8% share)
- **Electronics & Telecommunication Seats**: ~35,000 (6% share)
- **AI/ML & Emerging Specializations**: Only 8,500 seats (7% of Computer Engineering)

Despite Maharashtra's dominance in technical education, **specialized programs in software development, advanced IT systems, AI/ML, and IoT-enabled electronics remain limited**, creating a significant gap between industry demand and academic supply.

| City | Computer Engineering Colleges | Total Seats | Software-Focused Programs |
|---|---|---|---|
| Pune | 185 | 28,500 | 12 programs |
| Mumbai | 142 | 22,000 | 8 programs |
| Nagpur | 98 | 15,200 | 5 programs |
| Nashik | 76 | 11,800 | 3 programs |

Similar trends are observed for **Information Technology and Electronics & Telecommunication**, where only a handful of institutions offer **AI integration, IoT-based systems, and advanced communication technologies**.

**CET Cell Statistics (2025):**

- **4.2 lakh candidates** appeared for MHT-CET.
- **Computer Engineering closing rank**: 85th percentile (top 15% performers).
- **Vacancy Trends**:
- 35% seats remain vacant in traditional branches like Civil and Mechanical Engineering.
- Software-specialized programs and AI tracks achieve **95%+ fill rates**, reflecting strong industry demand.

**Technical Education Scenario - Software Development Focus**

- **Software Development Specializations** in Computer Engineering have grown by **40% in the past three years**, yet they meet only **40% of industry demand**.
- Pune dominates with **185 engineering colleges**, but only **12 offer dedicated tracks in full-stack development, DevOps, cloud-native architecture, and AI-driven solutions**.
- **Electronics & Telecommunication programs** are gradually incorporating **IoT, embedded systems, and 5G technologies**, but advanced AI integration is still rare.
- **Artificial Intelligence programs** remain niche, with limited seats and high competition, despite AI being a critical enabler for automation, smart cities, and digital transformation.

**c. Status at Entry Level**

As prescribed by AICTE norms.

**d. Status of Technical Level manpower**

Maharashtra's technology ecosystem is experiencing unprecedented growth, driven by **IT services, product development, telecom advancements, and AI-driven solutions**. However, there is a significant gap between industry requirements and the skill sets of graduating engineers. While the state produces thousands of engineering graduates annually, only a fraction possess **specialized competencies in full-stack development, DevOps, cloud-native architecture, advanced networking, IoT systems, and AI/ML technologies**.

**Current Scenario**

- **Annual Absorption**: Maharashtra's IT and allied sectors employ **1.2 lakh professionals annually**, yet **only 40% of engineering graduates meet modern deployment and automation standards**.
- **Emerging Domains**:
    - **Computer Engineering & IT**: High demand for **full-stack developers, cloud architects, cybersecurity specialists, and DevOps engineers**.
    - **Electronics & Telecommunication**: Growing need for **IoT engineers, embedded system designers, and 5G network specialists**.
    - **Artificial Intelligence**: Acute shortage of **AI/ML engineers, data scientists, and NLP experts**, with demand projected to grow by **50% annually**.

**Employment Distribution**

- **IT Services (70%):** Leading firms such as **TCS, Infosys, Wipro, Capgemini** hire bulk talent for **enterprise application development, cloud migration, and digital transformation projects**, offering packages in the range of **₹9–15 LPA**.
- **Product Companies (20%):** Organizations like **Zoho, Freshworks, Postman, and AI-driven startups** recruit for **SaaS platforms, API development, AI-powered applications, and product innovation**, with compensation ranging from **₹15–25 LPA**.
- **Startups & Innovation (10%):** Entrepreneurship is gaining momentum, supported by **incubation centers such as MITAOE**, which provide **seed funding, mentorship, and**

**co-working spaces for 50+ ventures annually**, focusing on **AI solutions, IoT products, and telecom innovations**.

**Skill Gap Analysis**

- **Full-Stack Development & DevOps**: 38–50% gap in industry-ready professionals.
- **Cloud Architecture & Cybersecurity**: 54% gap, especially in AWS/Azure-certified talent.
- **AI/ML & Data Science**: 57% gap, with limited integration in current curricula.
- **IoT & Embedded Systems**: 53% gap, despite rising demand in smart devices and automation.

**e. Industrial Scenario of the State**.

Maharashtra remains India's industrial powerhouse, with a projected GSDP of **₹40.44 lakh crore (US$490 billion) for FY 2023-24**, marking a real growth rate of **7.6% compared to the previous year**. The state attracted a significant share of foreign investment while **Magnetic Maharashtra 2.0 secured ₹1.13 lakh crore in investment proposals**, promising approximately **2.5 lakh new job opportunities**.

**IT/ITeS Sector Highlights**

- **Exports:** ₹1.05 lakh crore (~US$13 billion) from Pune alone in FY 2023-24.
- **Contribution to national exports:** ~18%, with the sector employing around **4.5 million professionals**
- **Annual growth rate:** 12–15% YoY, with **India's IT exports projected to reach US$100 billion by 2028**.

**Major Industrial & Software Clusters:**

| Cluster | Major Companies | Annual Software Engineering Demand |
|---|---|---|
| **Pune (Hinjewadi, Magarpatta)** | TCS, Infosys, Wipro, Tech Mahindra, Cyient | 25,000 |
| **Mumbai (Fintech)** | PhonePe, Razorpay, PayU, HDFC Fintech | 12,000 |
| **Nagpur (MIHAN SEZ)** | HCL, Persistent Systems | 8,000 |
| **Aurangabad (Auto-IT)** | KPIT, Tata Elxsi | 6,000 |

**Thrust Sectors Fueling Demand:**

- ITeS & Digital Services (ERP/CRM modernization, cloud migration)
- Fintech (UPI, lending platforms, blockchain)
- E-commerce & Logistics (full-stack platforms)
- Industry 4.0 (IoT, predictive maintenance)
- Gaming & EdTech (VR/AR, SaaS)

**Plug & Play Advantage:** MIDC provides swifter deployment for software firms by offering ready-to-use factories, advanced data centres, 100% power backup, and high-speed fiber connectivity.

**Employment Projections (2025–30):**

- **Annual requirement:** 120,000 software engineers
- **Current skilled graduate output:** ~72,000
- **Shortfall:** ≈40% gap in supply

Despite Pune housing **4.5 million IT professionals**, it still requires **25,000 new full-stack developers each year**, yet current educational programs meet only around **35% of this need**.

**Government Initiatives Catalyzing Growth:**

- **Magnetic Maharashtra 2.0**: ₹1.13 lakh crore investments aimed at boosting the IT/ITeS sector.
- **Maharashtra State Innovation Policy**: Reservation of **20% seats in startup/incubation-focused academic programs**.
- **Digital Maharashtra Mission**: Incentives and funding targeted at **Cloud-native, AI/ML, and DevOps education**.

This strategic alignment between **economic growth**, **technology demand**, and **education policy**, underscores the urgent need for UG programs in **Computer Engineering, IT, Electronics & Telecommunication Engineering, and Artificial Intelligence**—to bridge the current gap and fuel Maharashtra's trajectory as India's digital and industrial leader.

**Maharashtra: Industrial and IT POwerhouse**

Maharashtra continues to lead India's economy with a **GSDP of ₹40.44 lakh crore (US$490 billion) in FY 2023-24**, growing at **7.6%**. The state accounts for **31% of India's FDI inflows** and secured **₹1.13 lakh crore investment proposals under Magnetic Maharashtra 2.0**, creating **2.5 lakh jobs**.

**IT/ITeS Sector Dominance**

- **Exports:** ₹1.05 lakh crore from Pune alone in FY 2023-24
- **Contribution:** ~18% of India's IT exports
- **Employment:** 4.5 million professionals
- **Growth:** 12–15% YoY; projected to reach **US$100 billion by 2028**

**Key Industrial Clusters and Demand**

| Cluster | Major Companies | Annual Software Demand |
|---|---|---|
| Pune IT Hub | TCS, Infosys, Wipro, Tech Mahindra | 25,000 engineers |
| Mumbai Fintech | PhonePe, Razorpay, PayU | 12,000 developers |
| Nagpur MIHAN SEZ | HCL, Persistent Systems | 8,000 full-stack roles |
| Aurangabad Auto-IT | KPIT, Tata Elxsi | 6,000 embedded software |

**Growth Drivers**

- **Digital Services:** ERP/CRM modernization, cloud migration
- **Fintech:** UPI, blockchain, digital lending
- **Industry 4.0:** IoT, predictive maintenance
- **Gaming & EdTech:** SaaS, VR/AR platforms

**Employment Outlook (2025-30)**

- **Annual Requirement:** 1.2 lakh software engineers
- **Current Supply:** ~72,000 skilled graduates
- **Gap:** ~40% shortfall

Pune alone needs **25,000 full-stack developers annually**, but current programs meet only **35% of demand**.

**f. Scope of the College vis-à-vis the Industrial Scenario and Educational Facilities in Maharashtra**

**MIT Academy of Engineering (MITAOE), Alandi, Pune**, established in **1999** under the aegis of **Maharashtra Academy of Engineering and Educational Research (MAEER)**, is affiliated with **Savitribai Phule Pune University (SPPU)** and approved by **AICTE**. Recognized by the Government of Maharashtra, MITAOE has emerged as a premier institution in technical education, offering **state-of-the-art infrastructure, advanced laboratories, and a highly qualified faculty team** committed to academic excellence.

The institute consistently achieves results above the university average and currently offers **ten undergraduate engineering programs, two postgraduate programs**.

Existing programs include:

1. **Mechanical Engineering** – UG & PG
2. **Chemical Engineering** – UG
3. **Computer Engineering** – UG, PG, Ph.D.
4. **Computer Science & Engineering (AI & ML)** – UG
5. **Computer Science & Engineering (Data Science)** – UG
6. **Computer Engineering (Software Engineering)** – UG
7. **Electronics & Telecommunication Engineering** – UG
8. **Information Technology** – UG
9. **Civil Engineering** – UG
10. **Design** – UG

MITAOE provides seamless **Wi-Fi-enabled campus with a 500 Mbps leased line (with proposed 2 GBPS)**, a modern **Internet Center with 180 higher end desktop machines and 7 dedicated servers**, and a **digital library**. The institute emphasizes **soft skills development through in-house Communication Skills courses**, and regularly conducts **faculty development programs, industry-oriented training, and collaborative projects** to ensure alignment with evolving technologies.

**Industrial and Educational Context**

Maharashtra remains India's **industrial and IT powerhouse**, contributing significantly to national GDP and hosting major clusters in **IT services, product development, telecom, and Industry 4.0 technologies**. The state's IT/ITeS sector employs **4.5 million professionals**, with annual demand for **1.2 lakh software engineers**, alongside growing requirements for **AI/ML specialists, IoT engineers, and embedded system designers**. Pune, as a leading technology hub, drives this demand with **25,000 full-stack developers needed annually**, while current educational programs meet only **35% of industry requirements**.

The state boasts **robust infrastructure, skilled manpower, and strong government initiatives** such as **Magnetic Maharashtra 2.0, Digital Maharashtra Mission, and Maharashtra Innovation Policy**, which prioritize **cloud-native, AI-driven, and telecom technologies**. However, there is a clear gap in specialized programs that integrate **Computer Engineering, Information Technology, Electronics & Telecommunication Engineering, and Artificial Intelligence** to meet industry expectations.

### 11.4 Academic Programmes

**a. Basic Academic Philosophy of the Institution**

**MIT Academy of Engineering (MITAOE)** embraces an autonomous curriculum philosophy that emphasizes **flexibility, industry integration, and holistic student development**. The academic framework is designed to prepare graduates for emerging roles in **Computer Engineering, Information Technology, Electronics & Telecommunication Engineering, and Artificial Intelligence**, ensuring alignment with global technology trends and the evolving industrial ecosystem.

**Core Principles**

- **Blended Learning Structure:** A balanced approach comprising **40% theoretical foundation**, **40% hands-on laboratory and project work**, and **20% industry internships**, enabling practical mastery and experiential learning.
- **Progressive Skill Development**
  - **Years 1–2**: Strong foundation in **programming, electronics fundamentals, data structures, digital systems, and communication technologies**.
  - **Years 3–4**: Advanced exposure to **microservices architecture, cloud-native platforms, AI/ML frameworks, IoT systems, 5G communication protocols, and production-grade deployments**.
- **Elective Flexibility:** Students can choose from **specialization tracks** such as **Full-Stack Development, Mobile Application Development, Cloud Architecture, Cybersecurity, Blockchain, AI & Data Science, IoT & Embedded Systems**, starting from the third year.
- **T-Shaped Competency Model:** Graduates develop **deep expertise in their chosen domain** while acquiring **broad interdisciplinary skills** in digital transformation, ensuring versatility across technology sectors.

**Teaching-Learning Methodology**

The pedagogy is anchored in **Outcome-Based Education (OBE)** and structured around four pillars:

- **Activity-Based Learning:** Hackathons, coding challenges, circuit design workshops, AI model building, and simulation exercises that replicate industry practices.
- **Project-Based Curriculum:** Semester-long capstone projects executed in collaboration with **industry partners such as TCS, Infosys, Tech Mahindra, Zoho, and AI-driven startups**, ensuring real-world exposure.

- **Collaborative Approach:** Advanced courses co-taught by **industry mentors and domain experts**, complemented by **mandatory six-month internships** for immersive professional experience.
- **ICT Integration:** Access to global platforms and tools including **AWS Educate, Google Cloud credits, GitHub Enterprise, MATLAB, and IoT simulation environments**, fostering cutting-edge learning.

**b. Types of Programmes**

**MIT Academy of Engineering (MITAOE)** offers **full-time undergraduate and postgraduate programs** in engineering and design, affiliated with **Savitribai Phule Pune University (SPPU)** and approved by **AICTE**. The programs are designed to meet industry requirements and foster innovation across multiple disciplines.

**Undergraduate Programs (B. Tech)**

1. **Mechanical Engineering** – Intake: 120
2. **Chemical Engineering** – Intake: 60
3. **Civil Engineering** – Intake: 60
4. **Electronics & Telecommunication Engineering** – Intake: 180
5. **Computer Engineering** – Intake: 360
6. **Computer Science & Engineering (Software Engineering)** – Intake: 180
7. **Computer Science & Engineering (Artificial Intelligence & Machine Learning)** – Intake: 180
8. **Computer Science & Engineering (Data Science)** – Intake: 120
9. **Information Technology** – Intake: 180

**Postgraduate Programs (M. Tech)**

10. **Computer Engineering** – Intake: 09
11. **Mechanical Engineering** – Intake: 18

**Design Program**

12. **Bachelor of Design (B.Des.)** – Intake: 150

**c. Identified Programmes**

**MIT Academy of Engineering** offers an exceptional academic environment dedicated to fostering excellence in education and research across emerging fields of engineering and technology. Over the past five years, the institute has consistently achieved near-complete enrollment in its undergraduate programs, reflecting its commitment to meeting local, regional, and national requirements for skilled technical professionals. In response to the increasing demand for expertise in high-impact domains, the institute proposes the introduction of **Off-Campus Undergraduate Programs**, as outlined below:

**Proposed Undergraduate Programs (Off-Campus)**

| Sr. No. | Branch | Proposed Intake |
|---|---|---|
| 01 | **Computer Engineering** | 120 |
| 02 | **Information Technology** | 120 |

| | | |
|---|---|---|
| 03 | **Electronics & Telecommunication Engineering** | 60 |
| 04 | **Artificial Intelligence** | 60 |

These programs are strategically aligned with **industry requirements in software development, IT infrastructure, advanced communication systems, and AI-driven technologies**, ensuring graduates are prepared for roles in **digital transformation, Industry 4.0, and next-generation innovation**.

**d. Phase-wise Introduction of Programmes and Intake**

The **First Year** of the proposed off-campus programs will commence from the **academic year 2026–27**, with subsequent phases following natural progression as per university norms.

**Proposed Schedule**

| Sr. No. | Course Name | Academic Year | Semester/Phase | Intake |
|---|---|---|---|---|
| 01 | **Computer Engineering** | 2026–27 | Semester I & II | 120 |
| | | 2027–28 | Semester III & IV | Natural Growth |
| | | 2028–29 | Semester V & VI | Natural Growth |
| | | 2029–30 | Semester VII & VIII | Natural Growth |
| 02 | **Information Technology** | 2026–27 | Semester I & II | 120 |
| | | 2027–28 onward | Subsequent Semesters | Natural Growth |
| 03 | **Electronics & Telecommunication Engineering** | 2026–27 | Semester I & II | 60 |
| | | 2027–28 onward | Subsequent Semesters | Natural Growth |
| 04 | **Artificial Intelligence** | 2026–27 | Semester I & II | 60 |
| | | 2027–28 onward | Subsequent Semesters | Natural Growth |

**e. Target Date for Start of Academic Programmes.**

The **First Year** of the proposed off-campus programs will begin in the **academic year 2026–27**. Subsequent years will follow a natural progression as per university norms:

- **Second Year**: Academic Year **2027–28**
- **Third Year**: Academic Year **2028–29**
- **Fourth Year**: Academic Year **2029–30**

This phased implementation ensures smooth onboarding, infrastructure readiness, and compliance with regulatory guidelines.

**MIT Academy of Engineering (Off-Campus) will provide a state-of-the-art central computing facility designed to offer students and faculty seamless access to advanced technology resources. The facility will include:**

- **High-Speed Internet Connectivity:** A dedicated leased line with 500 Mbps bandwidth will ensure uninterrupted and fast internet access for academic and research activities.
- **Modern Server Infrastructure:** IBM enterprise-grade servers will be deployed and integrated through a structured network architecture for optimal performance and reliability.
- **Robust Power Backup:** Centralized UPS systems with 396 KVA capacity, along with an additional 420 KVA backup, will guarantee continuous operation during power outages.
- **Student Internet Center:** A well-equipped browsing center with multiple workstations will be available for research and project work.
- **Printing Services:** Convenient printing facilities will be provided for both students and faculty within the computing labs.

This advanced infrastructure will support high-performance computing, cloud-based applications, and collaborative learning environments, ensuring students remain at the forefront of technological innovation.

**f. Central library**

The Central Library at MIT Academy of Engineering (Off-Campus) will be a modern facility offering a conducive environment for learning and research. It will feature air-conditioned reading spaces for 250 students, dedicated sections for journals and reference materials, and fully automated operations using advanced library management software. Students and faculty will have access to extensive digital resources, including DELNET and IEEE subscriptions, along with services like book reservation, reference assistance, and resource sharing. The library will remain open seven days a week to ensure maximum accessibility.

**g. Central Workshop**

The Off-Campus center will develop a dedicated workshop area of 200 sq. m, equipped with essential tools and machinery to provide practical training aligned with the prescribed curriculum. It will include facilities for Fitting, Carpentry, Welding, Sheet Metal, and basic Machine operations, ensuring students gain hands-on experience in fabrication and job exercises. The workshop will support courses on Workshop Practice offered during the first and second terms for all First-Year and Second-Year Engineering programs

**h. Central Instrumentation Facility**

The college does not currently have a dedicated central instrumentation facility. However, **basic instrumentation resources will be provided within the Central Workshop**, which will be utilized to support essential practical and fabrication requirements.

**i. Affiliating Body**

The MIT Academy of Engineering is conferred academic autonomous status since 2016 and is affiliated to **Savitribai Phule Pune University**, Pune. **The Savitribai Phule Pune University** is a **state-owned** university located in Pune, Maharashtra, India. It conducts undergraduate as well as post graduate programs in a variety of fields such as Arts, Science, Commerce, Engineering, Architecture, Pharmacology, Medicine, Law and Business Administration. The university offers **159 majors** of study under **13 faculties**. The **411-acre university campus** has graduate, Masters and Doctorate programs in specialized fields of science and arts and is chiefly concerned with research. There are almost **612 colleges affiliated** to the university, which offer various programs (including the undergraduate programs) of the university.
The University of Pune houses **IUCAA** (Inter University Center for Astronomy and Astrophysics) and **TIFR's NCRA** (National Center for Radio Astronomy) which is currently engaged in **GMRT** (Giant Meter wave Radio Telescope) projects, the largest of its kind in the world. The campus also has the **C-DAC** (Center for Development of Advanced Computing) which has indigenously developed the supercomputer **PARAM-10000**. The engineering programs of the university are available in **59 affiliated Engineering Colleges**. Admissions to these colleges are centrally administered by the Directorate of Technical Education of the Govt. of Maharashtra. The program structure is decided by representative professors of the participating colleges forming the faculty of engineering. Although courses are taught independently at the affiliated colleges, they have a common syllabus and requirements. Undergraduate programs last four years and lead to a Bachelor of Engineering (B.E.) / Bachelor of Technology (B. Tech) degree. Graduate programs lead to either Master of Engineering (M.E.) / Master of Technology (M. Tech) or Doctor of Philosophy (Ph.D.) degrees. The University of Pune has one of the largest engineering programs with almost 30,000 undergraduate students in various branches like mechanical, civil, electrical, computer, chemical, polymer, industrial and production engineering. It is rated as one of the best engineering programs in the country.

**j. Scholarships**

MITAOE will offer merit-based financial assistance to undergraduate and postgraduate students through full or partial tuition fee exemptions and reimbursements. Postgraduate students with a valid GATE score will be eligible to apply for stipends under the AICTE scheme. For full-time PG Students admitted at MITAOE, a Fellowship will be provided for a period of two years, with a monthly stipend of ₹25,000, subject to annual performance evaluations.

To promote innovation and collaboration, seed funding will be provided for potential and interdisciplinary B.Tech and M. Tech projects. Additionally, MITAOE will continue its annual scholarship program in the form of tuition fee waivers. Eligible students from backward categories will benefit from Maharashtra Government scholarships, and **all eligible girl students will receive a 100% tuition fee waiver**, reinforcing the institute's commitment to accessibility and inclusivity in education.

**k. Preventive measures of Ragging:**

The Off-Campus center will implement a comprehensive set of measures to eliminate ragging and ensure a safe, student-friendly environment:

- **Formation of Committees:** An Anti-Ragging Committee and an Anti-Ragging Squad will be established to monitor and enforce preventive actions.
- **Dedicated Cell:** An Anti-Ragging Cell will be created for continuous vigilance and prompt response.
- **Surveillance:** CCTV cameras will be installed at strategic locations across the campus and hostels.
- **Awareness Programs:** Anti-Ragging Workshops will be conducted, and institutional websites will be updated with details of Nodal Officers, helpline numbers, and emergency contacts.
- **Student Engagement:** Regular interaction and counseling sessions will be organized to promote awareness and address concerns.
- **Risk Identification:** Potential trouble triggers will be proactively identified to prevent incidents.
- **Information Dissemination:** Anti-Ragging guidelines and warnings will be included in the institution's prospectus, brochures, and information booklets.
- **Surprise Inspections:** Periodic checks will be carried out in hostels, student accommodations, canteens, recreational areas, toilets, and bus stands to deter any misconduct.

These measures will collectively foster a safe, respectful, and inclusive campus environment, ensuring zero tolerance toward ragging.

### l. Welfare measures for Faculty, Staffs and Students

The institute is committed to the holistic development and well-being of its faculty, staff, and students through the following initiatives:

- **Professional Membership Support:** Financial assistance covering **50% of the registration fees** for up to **two memberships** in reputed professional bodies.
- **Support for Academic Engagement:** Funding for **seminars, workshops, and conferences** (national and international) including **registration fees, travel, and accommodation**, subject to recommendations from DRC and RRC. Additionally, **Professional Development Leave** is granted for such engagements.
- **Seed Grant for Research:** Provision of a **seed grant up to ₹2,00,000** to faculty for initial setup costs of research projects, fostering collaborations with universities, institutions, and industries at national and international levels.
- **Sabbatical and Study Leave Policy:** Faculty and staff may avail **sabbatical leave** for career development through specialized training or higher education. Study leave provisions include:
    - **Up to 3 years** for pursuing a Ph.D.
    - **Up to 1 year** for Postdoctoral programs.

- **Incentives for Funded Projects:** Faculty securing **funded projects above ₹10 lakhs** from DST, AICTE, UGC, government bodies, or private industry are eligible for **additional increments** in pay.
- **Ph.D. Completion Benefits:** Faculty completing a Ph.D. degree will receive **three increments**, effective from the month of issuance of the provisional degree certificate.
- **Recognition for Awards:** Faculty receiving **national or international awards** will be entitled to **one increment**, based on RRC recommendations.
- **Medical Insurance:**
    - **Group Medical Insurance Policy** with an institute contribution of ₹1,000 per employee.
    - Employees opting for individual policies can claim **₹1,000 reimbursement** upon submission of relevant documents.
- **Special Coverage for Drivers:** Separate **family medicare policy** for drivers, ensuring **on-duty accidental benefits**.

Similar welfare policy will be implemented for off campus of MIT Academy of Engineering.

**5 In case of PGDM Programmes, comprehensive details in respect of admission procedure, Programme structure, curriculum outline and contents, evaluation system etc. should necessarily be submitted. PGDM Programmes shall be regulated as per Appendix 9.**

Not Applicable

**6 Salient Features of Academic Programmes**

a. **Classification of Academic Divisions i.e. Departments, Centres, Schools, Central Academic Facilities.**

The off campus of MIT Academy of Engineering, Alandi (D), will offers **UG programmes,** namely,

1. Computer Engineering
2. Electronics and Telecommunication Engineering
3. Information Technology
4. Artificial Intelligence

b. **Details of each Academic Department/ Centre, such as:**

**Academic Objectives**

The academic philosophy across the four proposed departments—**Computer Engineering, Information Technology, Electronics & Telecommunication Engineering, and Artificial Intelligence**—is to achieve global excellence in **teaching, research, and technology development**. Each program aims to empower learners with **industry-relevant skills,**

**interdisciplinary knowledge, and innovation-driven competencies**, ensuring graduates become leaders in the digital economy.

**Common Objectives for All Programs:**

1. **Academic Excellence**: Deliver rigorous, outcome-based education aligned with global standards.
2. **T-Shaped Skill Development**: Cultivate deep domain expertise complemented by broad digital transformation capabilities.
3. **Global Exposure**: Provide national and international platforms for showcasing talent through conferences, hackathons, and exchange programs.
4. **Research Culture**: Foster innovation through student-led projects, publications, and patents.
5. **Faculty Development**: Continuous training and upskilling for faculty to stay abreast of emerging technologies.
6. **Industry Readiness**: Ensure graduates are equipped for immediate deployment in high-demand roles through internships, certifications, and live projects.

- **Areas of Focus**

**1. Computer Engineering**

- **Core Domains**: Full-Stack Development, DevOps & Automation, Cloud Computing, Software Architecture.
- **Emerging Technologies**: Blockchain, Edge Computing, AI-assisted development.
- **Research Themes**: Sustainable software engineering, distributed systems optimization, application security.

**2. Information Technology**

- **Core Domains**: IT infrastructure management, enterprise systems, database optimization, cybersecurity.
- **Emerging Technologies**: Cloud services, virtualization, IT governance frameworks.
- **Research Themes**: Secure IT architectures, digital service delivery, ERP modernization.

**3. Electronics & Telecommunication Engineering**

- **Core Domains**: Embedded systems, VLSI design, signal processing, wireless communication.
- **Emerging Technologies**: IoT platforms, 5G networks, sensor integration.
- **Research Themes**: Smart device design, energy-efficient communication systems, AI-enabled telecom solutions.

**4. Artificial Intelligence**

- **Core Domains**: Machine Learning, Deep Learning, Natural Language Processing, Computer Vision.
- **Emerging Technologies**: Robotics, AI ethics, autonomous systems.
- **Research Themes**: Explainable AI, predictive analytics, AI for healthcare and smart cities.

**Academic Programme**

Each program is a **full-time, four-year B.Tech degree** comprising **eight semesters**. The curriculum is designed and approved by the respective **Board of Studies** under **Savitribai Phule Pune University**, ensuring compliance with AICTE norms and industry standards.

**Highlights:**

- **Year 1–2**: Foundational courses in programming, electronics, mathematics, and communication systems.
- **Year 3–4**: Advanced specialization tracks, industry certifications (AWS, Azure, AI/ML), and capstone projects.
- **Mandatory Internship**: Six-month industry internship for experiential learning.
- **Elective Tracks**: Full-Stack Development, Cloud Architecture, Cybersecurity, IoT Systems, AI & Data Science.

**The example of UG**-Computer Engineering is given as below:

| Year / Sem | First Year | Second Year | Third Year | Final Year |
|---|---|---|---|---|
| Sem I | Calculus and Differential Equations | Applied Mathematics | Software Architecture | Software Engineering, Testing and Quality Assurance |
| | Science of Nature | Engineering Informatics | Software Design | Department (Program) Elective – Refer Annexure |
| | Applied Mechanics | Data Structures | Computer Networks | Open Elective – Refer Annexure |
| | English for Engineers (German/Japanese) | Discrete Structure and Graph Theory | | |
| | Open Elective | Sociology | | |
| | Logic Development – C Programming | Computer Graphics | Project Management | Business Strategies / Advanced Skill Development Lab (Adv. Java / R Programming / Python with Kali Linux) |
| | Design Thinking | Programming Lab | Skill Development Course – Red Hat Linux / Web Technology | Project – I |
| | | Digital Prototyping | Project Design | Summer Internship |
| | | Minor Project – Design | | |
| | | Skill Development Course – CPP / Core Java | | |
| | | Environmental Sciences | | |

| Year / Sem | First Year | Second Year | Third Year | Final Year |
|---|---|---|---|---|
| Sem II | Statistics and Integral Calculus | Applied Mathematics | Design Analysis and Algorithms | Human Computer Interaction |
| | Engineering Physics | Engineering Informatics | Software Project Management | Department (Program) Elective – Refer Annexure |
| | Electrical and Electronics Engineering | Advanced Data Structures | Software Testing | Open Elective – Refer Annexure |
| | Engineering Graphics | Operating System | | |
| | Open Elective | Engineering Economics | | |
| | Applications Programming – Python | Database Management System | Skill Development Course – Adv. Java / .NET Core / Red Hat Linux | Project – II |
| | Experimental Tools and Techniques | Rapid Prototyping | Project – Implementation | |
| | Indian Constitution | Minor Project – Implementation | Employability and Career Development | |
| | | Professional Skill | | |
| | | Liberal Learning | | |

- **Faculty Requirement and Phase-wise Recruitment**

| Phase | Professor | Associate Professor | Assistant Professor | Total |
|---|---|---|---|---|
| I | 01 | 02 | 15 | 18 |
| II | 05 | 10 | 39 | 54 |
| III | | | | |
| IV | | | | |
| **Total Faculty** | **06** | **12** | **54** | **72** |

- **Requirement of Laboratories, Space and Equipment (cost)**

| Sl. No. | Laboratory | Qty | Equipment | Space (Sq. mt) | Approximate Cost (Rs.) |
|---|---|---|---|---|---|
| 1 | Laboratory | 32 | Desktop Computers, Printer, Server, Scanner, Digital Signal Oscilloscope, Functional Generators, Power Electronic Kits, Communication Equipment, Logic Analyzer (21 Channel), Data acquisition | 2112 (Ready) | 16,00,00,000/- |

| | | | | | |
|---|---|---|---|---|---|
| | | | system, PYNQ Boards, POWERSIM, MULTISIM | | |

- **Requirement of other Space like Class Rooms, Faculty Rooms, Departmental Office**

| Head | No of Div | 2026-27 Phase I | | 2027-28 Phase II | | 2028-29 Phase III | | 2029-2030 Phase IV | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No of rooms | Carpet Area(Sqm) | No of rooms | Carpet Area(Sqm) | No of rooms | Carpet Area(Sqm) | No of rooms | Carpet Area(Sqm) | No of rooms | Carpet Area(Sqm) |
| Class room | 6 | 3 | 198 | 6 | 396 | 9 | 594 | 12 | 792 | 12 | 792 |
| Laboratory | 6 | 8 | 528 | 16 | 1056 | 24 | 1584 | 32 | 2112 | 32 | 2112 |
| First Year Laboratory | 6 | 3 | 198 | -- | -- | -- | -- | -- | -- | 3 | 198 |
| CAD Center | 6 | 1 | 132 | -- | -- | -- | -- | -- | -- | 1 | 132 |
| Workshop | 6 | 1 | 200 | -- | -- | -- | -- | -- | -- | 1 | 200 |
| Tutorial room | 6 | 1 | 33 | 2 | 66 | 3 | 99 | 4 | 132 | 4 | 132 |
| Computer Center | 6 | 1 | 150 | -- | -- | -- | -- | -- | -- | 1 | 150 |
| Seminar Hall | 6 | 1 | 132 | -- | -- | -- | -- | -- | -- | 1 | 132 |
| Library | 6 | 1 | 400 | -- | -- | -- | -- | -- | -- | 1 | 400 |
| Language lab | 6 | 1 | 33 | -- | -- | -- | -- | -- | -- | 1 | 33 |
| Department Office | 6 | 4 | 80 | -- | -- | -- | -- | -- | -- | 4 | 80 |
| Faculty rooms | 6 | 18 | 90 | 36 | 180 | 54 | 270 | -- | -- | 54 | 270 |

### 7. Quality and Human Resource Development

The proposed off-campus center of **MIT Academy of Engineering (MITAOE)** will operate under the same quality ethos and human resource policies as the main campus, with structured support for policy deployment, faculty development, and continuous quality improvement. The

Management's policies focus on **promoting excellence among faculty and staff**, **attracting and retaining high-caliber talent**, and **implementing robust quality systems** to foster academic distinction across both locations.

**a. Academic Values**

The off-campus center adheres to MITAOE's core academic values, implemented with guidance and oversight from the main campus:

- **Student-Centric Learning Environment:** Learning experiences are designed around student outcomes, accessibility, and individualized academic support.
- **Process-Driven Teaching–Learning for Continuous Improvement:** A documented, process-based approach (lesson planning, delivery, assessment, and review) ensures measurable improvement in academic quality.
- **Blended Pedagogy (Traditional + LMS + ICT):** Activity-based, collaborative, and "learning-by-doing" methods are delivered through classroom teaching, **LMS**, and **ICT** tools to enhance engagement and achievement.
- **Strong Fundamentals and Analytical Rigor:** Emphasis on concepts, understanding, problem-solving, and design thinking to build durable competencies.
- **Multidisciplinary Orientation:** Integration across disciplines to address real-world problems and societal needs.
- **Scientific Reasoning and Research Temper:** Systematic encouragement of inquiry, experimentation, and evidence-based thinking.
- **Periodic Curriculum Review Aligned to Industry 4.0**
  Regular updates to include **Embedded Systems, IoT, Cyber Security, Data Science & Analytics, Machine Learning, AI, Product Design, and Robotics**, ensuring industry-relevant learning.
- **21st-Century Skills**
  Focus on **creative, cognitive, critical thinking, communication, and collaboration** skills across all programs.

**b. Recruitment, Attraction & Retention of Faculty; Promotional Avenues and Career Ladder**

MITAOE recognizes the competitive landscape in recruiting and retaining talented faculty. The off-campus center follows a transparent, merit-driven process, implemented by the **Human Resource Department (HRD)** under the purview of the **Principal, Heads of Department (HoDs), Registrar, and Faculty & Staff Affairs (FSA)**—with strategic and operational backing from the main campus.

**Structured Recruitment Process**

- **Workforce Planning & Needs Assessment:** Annual manpower planning to determine current and future requirements by discipline and functional unit.
- **Job Analysis & Evaluation:** Clear role definitions, responsibilities, and competency matrices to ensure right fit and role clarity.
- **Qualification & Profile Assessment:** Selection criteria anchored in subject expertise, pedagogical ability, research potential, and industry exposure.
- **Compensation Benchmarking:** Offers aligned to institutional pay structures and budget frameworks.

- **Equitable, Bias-Free Selection:** Documented recruitment and selection procedures ensure equal opportunity and compliance with statutory requirements.

**Sourcing Channels**

- Public advertisements (newspapers), walk-in drives, and **institutional website (www.mitaoe.ac.in)**.
- Targeted outreach to **Training & Placement cells at IITs/NITs** and reputed universities to attract top graduates and doctoral/post-doctoral talent.

**Transparency and Equal Opportunity**

- Open internal competition for advertised roles; no "courtesy interviews."
- Terms of appointment communicated clearly prior to joining.
- **Equal opportunity employer**—women faculty hold key roles; candidates from **weaker and backward sections** are provided fair access as per policy.
- **Reservation norms** are duly implemented; applications are proactively sought through SPPU's reservation cell.
- **Domicile preference** may be considered for local engagement, while **merit remains paramount** in selection.

**Onboarding, Empowerment, and Mentoring**

- Defined authority, responsibilities, and workload norms communicated at induction.
- **Dean/Academic Leaders** guide faculty to align with institutional academic values and goals.

**Promotional Avenues & Career Ladder**

- Performance-based progression tied to teaching quality, research output, funded projects, community engagement, and academic leadership—harmonized across main and off-campus centers.

**Main Campus Support:** Central panels for interviews, shared HR policy manuals, cross-campus mentoring, joint faculty development programs, sabbatical and study-leave administration, and facilitation for collaborative grants bolster the off-campus talent pipeline.

c. **Policies for Teaching and Non-Teaching Staff Development**

MIT Academy of Engineering places **students' welfare at the core of its policies**, followed by the well-being of employees and society at large. The institution's approach is built on **mutual trust, fairness, and a win-win philosophy**, ensuring a positive work culture, competency mapping, and enhanced employee performance.

Policy Review and Governance

- The **Governing Body**, **Deans**, and committee chairpersons periodically review policy guidelines to assess their effectiveness and ensure robust implementation.
- Since inception, the institute has adhered strictly to **AICTE** and **SPPU** norms for faculty and staff recruitment and development.

Recruitment and Induction

- Recruitment processes are **transparent and merit-based**, eliminating courtesy interviews.
- All applications are routed through the **HR Executive** to prevent favoritism or bias.
- Job openings are widely advertised with adequate time for applications.
- A **qualified panel** conducts interviews, and selected candidates undergo structured **orientation and induction programs**.

**Institutional Committees**

To ensure smooth functioning and compliance, the institute has constituted statutory and non-statutory committees as per **UGC guidelines**, including:

- Governing Body, Academic Council, Board of Studies, Finance Committee
- Internal Complaint Committee, Examination Committee, Anti-Ragging Committee
- Research & Development Committee, Student Welfare Committee, Internal Quality Assurance Cell
- Academic & Administrative Audit Committee, Planning & Evaluation Committee
- Library Committee, Disciplinary & Grievance Redressal Committee, Caste Grievance Committee
- Admission Committee, Food & Accommodation Committee, Institute Development Committee

**Key Policy Guidelines**

- **Disability Policy:** No discrimination against qualified applicants or employees with disabilities; reasonable accommodations provided.
- **Equal Employment Opportunity:** No bias based on caste, creed, religion, or gender.
- **Sexual Harassment Policy:** Zero tolerance; Internal Complaint Committee addresses grievances. Employees found guilty are subject to termination without appeal.
- **Employee Safety Policy:** Safe and secure workplace ensured through certified equipment, well-designed labs, and emergency medical facilities.
- **Grievance Redressal Policy:** Employees may raise grievances confidentially. A formal process involving the Director, Grievance Committee, and Governing Body ensures impartial resolution through documented hearings.

**Organizational Structure**

To minimize friction between academic and administrative units, the institute maintains a **flat departmental structure**, ensuring clarity in hierarchy, roles, and responsibilities.

At **MIT Academy of Engineering (MITAOE)**, employee development is a structured and continuous process aimed at fostering excellence and long-term engagement.

Probation and Performance Assessment

- All employees undergo a **two-year probation period**, enabling comprehensive evaluation by **HoD and Section Heads**.
- This period serves as a mutual assessment phase for both the employee and the institution to ensure alignment with organizational goals.

Feedback Mechanisms

- **Student Feedback:** Collected **bi-annually (once per semester)** to provide constructive insights for faculty improvement and engagement. Feedback is developmental, not punitive, and informs targeted training programs.
- **Employee Feedback:** Conducted **annually** as a strategic tool to monitor policy effectiveness and enhance workplace practices.

Career Development and Promotions

- Career advancement policies include **deputation for higher studies**, **timely promotions**, and **increments** linked to **bi-annual performance appraisals**.

- Appraisals consider **student feedback**, **departmental performance**, **technical skill enhancement**, **initiatives undertaken**, and **teamwork capabilities**.

Professional Growth and Exposure

- Employees are encouraged to engage in **national and international academic interactions** through support for **paper publications**, **patent filings**, and participation in **seminars, STTPs, workshops, and QIPs**.
- A well-defined **welfare scheme** ensures financial and institutional support for professional development.

Training and Development

- Training programs aim not only at **skill enhancement** but also at preparing employees for **higher responsibilities and promotions**, fostering healthy competition and growth.
- Initiatives include **R&D projects**, **Industry-Institute Interaction**, **industrial visits**, **guest lectures**, and **expert sessions**.
- Employees are regularly deputed for **internal and external training**, with records maintained in their personal files.

Operational Clarity and Academic Continuity

- **Structured timetables** for each program and class ensure clarity in teaching schedules and assessments.
- All faculty appointments are **full-time and permanent**, minimizing disruptions in the teaching-learning process and reducing administrative workload.

Retention and Work Environment

- MITAOE offers **competitive pay and perks**, recognizing that retention of skilled manpower requires a **positive work environment**, **work-life balance**, and **job satisfaction**.
- The institute prioritizes **employee well-being**, understanding that short-term costs of robust policies yield long-term benefits in talent retention and institutional excellence.

Policy Updates and Communication

- The **Human Resource Department** regularly updates the **HR Manual** with new policies and ensures timely communication to all employees.
- HR also assists in **policy interpretation**, promoting transparency and clarity.

d. **Permanent and Contractual Services for Teaching, Non-Teaching, and Support Personnel**

Our recruitment strategy for teaching and non-teaching personnel—whether on a permanent or contractual basis—is driven by our commitment to enhancing the teaching-learning process and ensuring its efficiency.

**Contractual Employment Policy:** Contractual appointments are never used as a means of intimidation or harassment. Instead, they serve as an opportunity for distinguished professionals to contribute to student learning without disrupting their ongoing research or academic engagements elsewhere. Most of our contractual or visiting faculty members are eminent experts from leading research organizations or senior industry positions.

**Competitive Compensation and Retention:** To attract and retain highly skilled and intellectual personnel, the institute often offers pay scales and benefits that exceed AICTE recommendations. This approach is essential given the competitive landscape, where numerous engineering colleges offer lucrative packages to meet short-term staffing needs.

**Support Staff Recruitment:** The growing demand for support staff, fueled by economic expansion in industry and services, necessitates competitive compensation. Our institute offers salaries and benefits above those recommended by AICTE and other government bodies, aligning with market realities to attract and retain the right talent for each role.

**Commitment to Excellence:**We are dedicated to building and sustaining a workforce of highly qualified faculty and staff to support our academic mission. Engineering education is inherently dynamic, requiring faculty and subject experts with cutting-edge knowledge aligned with industry trends and emerging technologies.

**Faculty Appointment and Selection:** All full-time faculty members are appointed in accordance with AICTE and UGC norms, on a permanent basis with a mandatory two-year probation period. To ensure transparency and quality, faculty selection is periodically reviewed and approved by panels from Savitribai Phule Pune University (SPPU). This process guarantees timely course delivery and eliminates gaps in the teaching-learning process.

**Engagement of Subject Experts:** In addition to permanent faculty, the institute engages domain experts from research institutions and industry as Adjunct, Visiting, or Industry Faculty. These professionals deliver specialized courses, guest lectures, workshops, and seminars, providing students with an edge in a highly competitive job market.

**Non-Teaching Staff:** The smooth functioning of the institute depends on dedicated support staff across departments such as Accounts, Purchase, Student Section, Library, Hostel, Clinic, Training & Placement, and Examination. Given their responsibility for handling confidential information and student records, these employees are appointed on a full-time, permanent basis with a two-year probation period.

**Outsourcing Policy:** While many organizations outsource services to improve efficiency and reduce overheads, MIT Academy of Engineering outsources only select services—such as housekeeping, maintenance, and security—to specialized agencies. We also employ in-house personnel to supervise and assist these agencies, ensuring quality control. Outsourcing is implemented solely to enhance service quality and aesthetics, without compromising academic delivery or causing job losses. Through reorganization and retraining, we ensure that affected employees are suitably placed in alternative roles.

**Our Philosophy:** We firmly believe that human resources are our most valuable asset. Fair and transparent service conditions are essential to building an institution that upholds value-based education of global standards.

## Total Quality Management (TQM) and Internal Quality Assurance Cell (IQAC)

### Introduction

In alignment with the National Assessment and Accreditation Council (NAAC) guidelines, every accredited institution is required to establish an **Internal Quality Assurance Cell (IQAC)** as a post-accreditation quality sustenance measure. Since quality enhancement is a continuous process, IQAC becomes an integral part of the institutional framework, working towards achieving the goals of quality improvement and sustainability.

The primary role of IQAC is to develop a structured system for conscious, consistent, and catalytic improvement in the overall performance of the institution. During the post-accreditation phase, IQAC channels all institutional efforts towards promoting holistic academic excellence.

IQAC is not intended to be a mere hierarchical structure or record-keeping body; rather, it functions as a **facilitative and participatory unit**, fostering a culture of quality through planned interventions similar to "Quality Circles" in industry.

**Objectives**

The primary objectives of IQAC are:

- To develop a system for conscious, consistent, and catalytic action to improve academic and administrative performance.
- To promote measures for institutional functioning that enhance quality through internalization of a quality culture and institutionalization of best practices.

**Strategies**

IQAC shall evolve mechanisms and procedures for:

- Ensuring timely, efficient, and progressive performance of academic, administrative, and financial tasks.
- Maintaining relevance and quality in academic and research programs.
- Promoting equitable access and affordability of academic programs for all sections of society.
- Optimizing and integrating modern teaching-learning methodologies.
- Ensuring credibility and transparency in evaluation processes.
- Maintaining adequacy and proper allocation of support structures and services.
- Facilitating research dissemination and networking with institutions in India and abroad.

**Functions**

Key functions of IQAC include:

- Developing and applying quality benchmarks for academic and administrative activities.
- Creating a learner-centric environment conducive to quality education and faculty development.
- Collecting and analyzing feedback from students, parents, and stakeholders on quality-related processes.
- Disseminating information on quality parameters in higher education.
- Organizing workshops, seminars, and promoting quality circles.
- Documenting programs and activities that lead to quality improvement.
- Acting as a nodal agency for coordinating quality-related initiatives and best practices.
- Maintaining an institutional database through MIS for quality enhancement.
- Preparing and submitting the **Annual Quality Assurance Report (AQAR)** to NAAC.

**Benefits**

IQAC contributes to:

- Enhanced clarity and focus in institutional functioning towards quality improvement.
- Internalization of quality culture across all levels.
- Coordination and institutionalization of best practices.
- Providing a sound basis for decision-making to improve institutional performance.
- Acting as a dynamic system for continuous quality enhancement.
- Establishing organized documentation and internal communication processes.

**Composition**

IQAC is constituted under the Chairmanship of the Head of the Institution and includes:

1. Chairperson: Head of the Institution

2. Senior administrative officers
3. Three to eight faculty members
4. One representative from Management
5. One or two nominees from local society, students, and alumni
6. One or two nominees from employers/industry/stakeholders
7. A senior faculty member as IQAC Coordinator/Director

Membership tenure is typically two years. IQAC meets at least once every quarter, and all proceedings—including agenda, minutes, and action-taken reports—are documented and maintained electronically.

**Role of the Coordinator**

The IQAC Coordinator plays a pivotal role in ensuring effective functioning. Ideally, the coordinator should be a senior academic or administrator with expertise in quality assurance and familiarity with digital tools for communication and documentation. Administrative support and secretarial assistance should be provided to facilitate smooth operations.

**Operational Features of the IQAC**

Quality assurance is the outcome of continuous efforts to define institutional objectives, develop actionable plans to achieve them, and establish checks and balances to evaluate the extent of accomplishment. The foundation of quality assurance lies in **commitment to improvement rather than mere institutional control**. Striking the right balance between institutional health and growth is essential.

The IQAC ensures that all academic and administrative activities undertaken by the institution are executed **efficiently, effectively, and in alignment with high standards of quality**. To achieve this, IQAC must first establish robust procedures and modalities for collecting and analyzing data related to various aspects of institutional functioning.

The **IQAC Coordinator and Secretary** play a pivotal role in implementing these processes. IQAC may leverage existing units and mechanisms within the institution to support its quality assurance functions. While the operational features and functions outlined are broad-based, institutions are encouraged to adapt them to their specific requirements to foster academic excellence.

**Accreditation Status on Main campus of MIT Academy of Engineering**

- **National Assessment and Accreditation Council (NAAC):** The institute is accredited with an **'A' Grade** by NAAC in both Cycle I and Cycle II.
- **National Board of Accreditation (NBA):** All eligible programs of the institute have been accredited by NBA, reflecting compliance with national quality standards.

**International Organization for Standardization (ISO)**

MIT Academy of Engineering is certified with the latest international standard **ISO 21001:2018**, which is specifically designed for educational organizations.

ISO standards ensure that products and services are **safe, reliable, and of high quality**. For institutions and businesses, these standards serve as strategic tools to **reduce costs by minimizing waste and errors, enhance productivity, and improve operational efficiency**. They also enable organizations to access new markets, create a level playing field for developing countries, and promote free and fair global trade.

At **MIT Academy of Engineering**, we are committed to delivering **excellence in education** by adhering to globally recognized quality standards and continuously improving our processes to provide the best possible learning experience.

- **Overall Teaching and Non-teaching Staff Requirements.**

**i. Teaching Staff**

| Phase | Professor | Associate Professor | Assistant Professor | Total |
|---|---|---|---|---|
| I | 01 | 02 | 15 | 18 |
| II | 05 | 10 | 39 | 54 |
| III | | | | |
| IV | | | | |
| **Total Faculty** | **06** | **12** | **54** | **72** |

**ii. Non-teaching Staff**

| Phase | Technical | Administrative | Peon | Total |
|---|---|---|---|---|
| I | 04 | 04 | 04 | 12 |
| II | 12 | 04 | 04 | 20 |
| III | | | | |
| IV | | | | |
| **Total** | **16** | **06** | **08** | **32** |

## 8 Linkages in Technical Education

### a. Introduction

**MIT Academy of Engineering (MITAOE)** establishes robust linkages across industry, academia, research institutions, and the community to ensure that the proposed **B.Tech programs in Computer Engineering, Information Technology, Electronics & Telecommunication Engineering, and Artificial Intelligence** align seamlessly with **industry requirements, national educational standards, and global best practices**. These partnerships foster **curriculum co-development, faculty development, student internships, joint research initiatives, and placement pipelines**, creating a dynamic ecosystem between academia and industry.

**Industry-Academia Collaborations**

- **Curriculum Advisory Boards**: Annual review by industry experts to integrate emerging technologies such as **microservices, Kubernetes, AI/ML frameworks, IoT systems, and 5G communication protocols**.
- **Mandatory Internships**: Minimum **6-month internship** for all students, with performance-based absorption into full-time roles.

- **Live Project Integration**: Semester-long projects executed for industry clients in domains like **cloud-native applications, embedded systems, and AI-driven solutions**.
- **Global Certifications**: Integration of certifications such as **AWS, Azure, Google Cloud, Cisco Networking, and AI/ML specializations**.

**Linkages with Industry**

To sharpen technical and professional skills, MITAOE collaborates with leading organizations through:

- **Innovative Projects**: Students undertake real-world projects in IT, telecom, and AI sectors as part of their curriculum.
- **Industrial Training**: Structured training during vacation periods to gain hands-on experience in **software development, IoT integration, and AI applications**.
- **Expert Lectures**: Industry professionals deliver sessions on emerging technologies, supported by **audio-visual aids and interactive formats**.
- **Industrial Visits**: Organized visits to IT parks, telecom hubs, and AI research centers to understand practical applications and workflows.
- **MoUs**: Formal agreements with companies for **faculty development, student internships, joint research, and placement support**.

**Linkages with the Community**

MITAOE emphasizes **social responsibility and inclusive education** through:

- **National Service Scheme (NSS) activities**
- **World Peace Center initiatives**
- **Computer literacy programs for underprivileged communities**
- **Blood donation and health camps**
- **Fee concessions and book bank facilities for economically weaker students and reserved categories**

**Linkages with other Technical Institutions in the region**

Collaborations with regional institutions for:

- **Faculty and student workshops**
- **Inter-college project competitions**
- **Design exhibitions and hackathons**
- **Sports and cultural exchange programs**

**Linkages with institutions of excellence such as the IITs and IISc. Bangalore Linkages abroad.**

- Faculty participation in **seminars, STTPs, and FDPs** at **IITs, NITs, and IISc**.
- **Library memberships** and access to digital resources from premier institutions.
- **Joint research projects and student exchange programs** with international universities such as **Dundee University (UK), Liverpool John Moores University, and Aberdeen University (Scotland)**.

**Linkages with R&D Laboratories:**

Strategic partnerships with **national and international R&D labs** to:

- Integrate **cutting-edge research in AI, IoT, and advanced communication systems** into the curriculum.
- Promote **innovation, patent development, and technology incubation**.

**Key R&D Collaborations**:

MIT Academy of Engineering fosters a strong research ecosystem through strategic partnerships with **national research bodies, industry leaders, and global institutions**, ensuring that students and faculty actively contribute to technological innovation. The focus spans **Computer Engineering, Information Technology, Electronics & Telecommunication Engineering, and Artificial Intelligence**.

**Core Initiatives**

- **Sponsored Research Centers:** Establishment of dedicated laboratories for **AI-driven software testing, blockchain security, IoT and edge computing frameworks**, funded by national and international research agencies.
- **Joint Research Projects:** Collaborative initiatives including **Ph.D. programs and sponsored projects** in areas such as **sustainable software architectures, automated DevOps pipelines, 5G-enabled communication systems, and AI-based predictive analytics**.
- **Technology Transfer:** Commercial licensing of **student-developed algorithms, IoT prototypes, and AI frameworks**, enabling industry adoption and entrepreneurship.
- **Research Fellowships:** Provision of **20 paid research positions annually** for undergraduate students to work on **live R&D challenges** in domains like **cloud-native systems, embedded electronics, and machine learning applications**.
- **Publication Pipeline:** Structured mentorship for **co-authoring research papers** with faculty and industry experts, targeting **Scopus-indexed journals, IEEE conferences, and patent filings**.

## 9 Governance, Academic and Administrative Management.

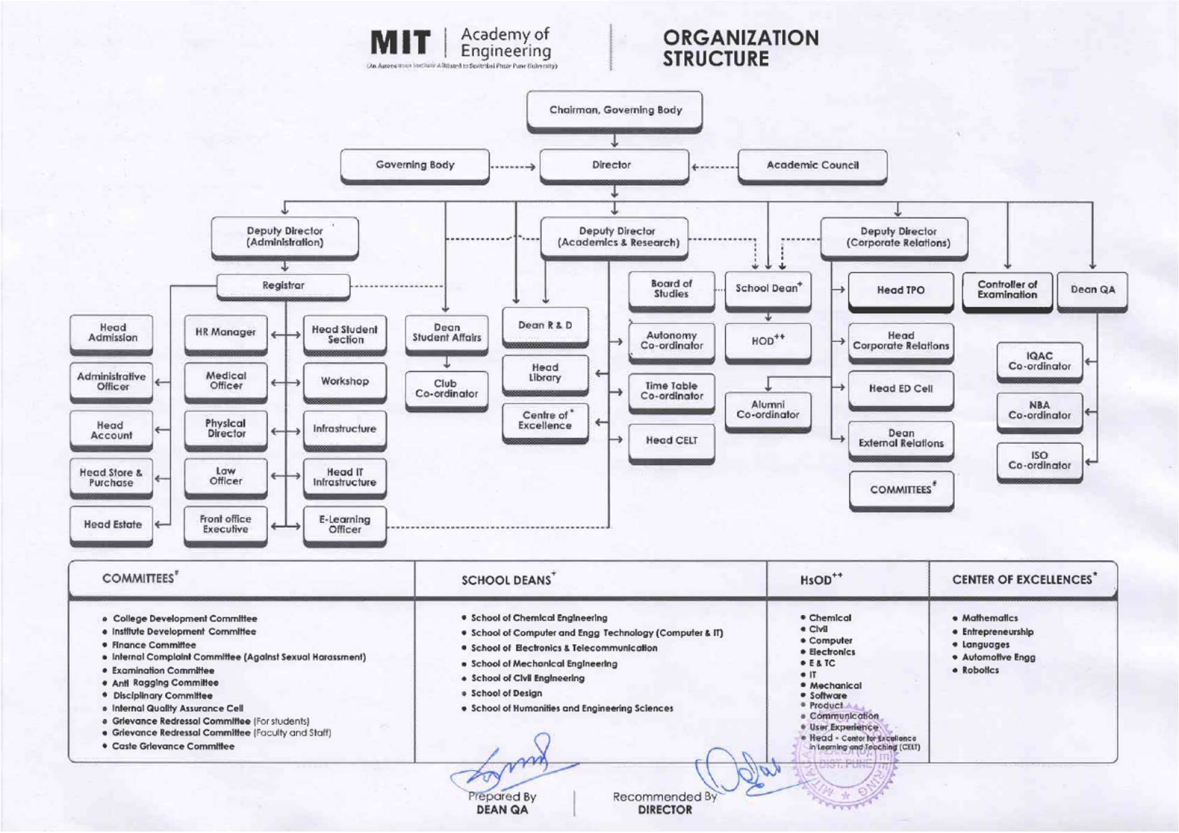
### a. Philosophy of Governance

- Education must be firmly grounded in principles and enriched by human values. At **MIT Academy of Engineering**, we uphold **quality as our highest priority**, fostering an environment that promotes **teaching, learning, research, and innovation**.
- Our governance philosophy is centered on the belief that **students come first**. Every decision and initiative reflects this commitment. The collective wisdom of the Society members, government officials, affiliating body representatives, and subject experts is directed toward achieving this goal.
- We envision our students not merely as graduates with engineering degrees but as **ambassadors of the institute**, equipped to make meaningful contributions to society. MIT Academy of Engineering ensures that every student who joins us undergoes a transformative journey—emerging as a **mature, responsible, and value-driven citizen** after four years of rigorous academic and personal development.
- Our ultimate aim is to create an experience that our alumni will **cherish for a lifetime**, reinforcing their bond with the institute and its ethos of excellence.

**b. Board of Governors**

| Sr. No. | Name of the Member | Profile | Designation |
|---|---|---|---|
| 1 | Dr. Sanjay Dhande | Padmashree Professor Sanjay Govind Dhande, former Director of IIT Kanpur, an innovative technologist, acclaimed academician, and institution builder | Chairman |
| 2 | Dr. Sunil Karad | Executive Director of MIT Group of Institutions; educationist, scholar, and visionary leader | Member |
| 3 | Prof. Anant Chakradeo | Dean of MIT Institute of Design and Director, International Relations for MIT Group of Institutions | Member |
| 4 | Dr. Yogesh Bhalerao | Recipient of 'Young Scientist Award from DST'; Director of MIT Academy of Engineering (MITAOE), Pune | Member Secretary |
| 5 | Dr. B.B. Ahuja | Director of College of Engineering, Pune (COEP) | Member |
| 6 | Prof. H.K. Abhyankar | Eminent academician; former Director of Vishwakarma Institute of Technology (VIT), Pune | Member |
| 7 | Dr. Sunil Bhagwat | Professor, Fergusson College, Pune | Member |
| 8 | Dr. N.S. Umrani | Former Pro-Vice Chancellor, Savitribai Phule Pune University (SPPU) | Invited Member |
| 9 | Dr. Mrs. Manju Singh | Secretary, University Grants Commission (UGC), Government of India | UGC Nominee |
| 10 | Dr. Aditya Abhyankar | Professor & Dean, Department of Technology, Savitribai Phule Pune University (SPPU) | Government of Maharashtra Nominee |
| 11 | Dr. Prashant Kumar | Indian Institute of Technology Kanpur | Member |
| 12 | Mr. Prakash Jagtap | Chairman and Managing Director, SAJ TEST PLANT PVT LTD | Member |
| 13 | Mr. Jiten Patil | Founder & Managing Partner, Quantum Orbit Consulting LLP | Member |
| 14 | Prof. B.P. Sabale | Ex-Vice Chancellor, YCMOU, Maharashtra | Member |
| 15 | Dr. Diptee Sakhare | Professor and HoD, Department of Electronics & Telecommunication Engineering | Member Faculty Representative |
| 16 | Dr. Suyogkumar Taralkar | Professor in Chemical Engineering and IQAC Coordinator | Member Faculty Representative |
| 17 | Mr. Amar More | Assistant Professor, School of Computer Engineering and Technology; Deputy Controller of Examination | Member Faculty Representative |

**c. Organizational Structure and Chart for day-to-day Operations and Management.**




d. **Role and Responsibilities of Key Senior Positions**.

Subject to the existing provision in the bye-laws of respective college and rules laid down by the state government/parent university, the Governing Body shall:

1) Guide the college while fulfilling the objectives for which the college has been granted autonomous status.
2) Institute scholarships, fellowships, studentships, medals, prizes and certificates on the recommendations of the Academic Council
3) Approve new programs of study leading to degrees and/or diplomas.
4) All recruitments of Teaching Faculty/Principal shall be made by the Governing Body/state government as applicable in accordance with the policies laid down by the UGC and State Government from time to time.
5) To approve annual budget of the college before submitting the same at the UGC.
6) Perform such other functions and institute committees, as may be necessary and deemed fit for the proper development of the college.

**Functions of Governing Body:**

The Governing Body as stated earlier is the Supreme Body responsible for the management of the institution. Its functions include the following:

**a. To form the following Sub-Committees and consider the recommendations made by these Committees:**

1. Academic Council
2. Board of Studies Committee
3. Finance Committee
4. Internal Complaints Committee
5. Examination Committee
6. Anti-Ragging Committee
7. Research & Development Committee
8. Students Welfare Committee
9. Students Extracurricular Committee
10. IQAC
11. Academic and Administrative Audit Committee
12. College Development Committee
13. Library Committee
14. Disciplinary and Grievance Committee
15. Caste Grievance Committee
16. Admission-hostel Committee
17. Food and accommodation Committee
18. Institution Development Committee
19. Staff Selection Committee

i. To approve the budget estimates – recurring and non-recurring for the financial year in advance.
ii. To scrutinize and accept the audited statement of account for each year
iii. To estimate the workload, approve the staffing pattern and create posts- Teaching and Non- Teaching (technical and administrative) for the institution.
iv. To consider and approve the proposals for creating of infrastructure such as building equipment, library and staff on a continuous basis.
v. To consider and make provisions for meeting the general and specific conditions laid down by the Council (AICTE), the State Government and Affiliating Body and monitor the progress in fulfilling the conditions.
vi. To consider the report of the Principal on status of admissions.
vii. To consider the report of the Principal on the academic performance of the students.
viii. To supervise the observance of service conditions of the staff as prescribed by the Affiliating Body/ Government.
ix. To consider the proposals of the Principal for improvement in academic performance of the Staff.
x. To consider any other matter in so far as it enhances the academic atmosphere in the institution.
xi. To consider any proposal for expansion of educational activities to be made to the Council/Government/ Affiliating Body.

**Major functions of sub-committees:**

**1. Academic Council**

i. Scrutinize and approve the proposals with or without modification of the Boards of Studies with regard to courses of study, academic regulations, curricula, syllabi and modifications thereof, instructional and evaluation arrangements, methods, procedures relevant thereto etc., provided that where the Academic Council differs on any proposal, it shall have the right to return the matter for reconsideration to the Board of Studies concerned or reject it, after giving reasons to do so.

ii. Make regulations regarding the admission of students to different programmes of study in the college keeping in view the policy of the Government.
iii. Make regulations for sports, extra-curricular activities, and proper maintenance and functioning of the playgrounds and hostels.
iv. Recommend to the Governing Body proposals for institution of new programmes of study.
v. Recommend to the Governing Body institution of scholarships, studentships, fellowships, prizes and medals, and to frame regulations for the award of the same.
vi. Advise the Governing Body on suggestions(s) pertaining to academic affairs made by it.
vii. Perform such other functions as may be assigned by the Governing Body.

**Constitution of Academic Council**

| Sr. No. | Name of the Member | Profile | Designation |
|---|---|---|---|
| 1 | Dr. Yogesh Bhalerao | Director, MIT Academy of Engineering | Chairman |
| 2 | Dr. Aditya Abhyankar | Professor & Dean, Department of Technology, Savitribai Phule Pune University (SPPU), Pune | University Nominee |
| 3 | Dr. D. S. Bormane | AISSMS's College of Engineering, Kennedy Road, Pune | Member |
| 4 | Dr. Suresh Gosavi | Department of Physics, Savitribai Phule Pune University (SPPU), Pune | Member |
| 5 | Dr. M. Sasikumar | Director, C-DAC, Mumbai | External Expert – Industry/Academics |
| 6 | Dr. S. P. Mahajan | Head, Electronics and Telecommunication Department, COEP, Pune | Member |
| 7 | Mr. Om Dhumal | Head – Operations, Knorr Bremse AG, Pune | Member |
| 8 | Mr. Pravin Kolhe | Superintending Engineer, Water Resource Department, Maharashtra | Member |
| 9 | Dr. B. B. Waphare | Principal, MAEER's MIT Arts, Commerce and Science College, Pune | Member |
| 10 | Dr. Mahesh D. Goudar | Professor, School of E&TC Engineering | Member |
| 11 | Dr. Sunita S. Barve | Deputy Director – Academics and Research, MIT Academy of Engineering | Member Secretary |
| 12 | Dr. Shitalkumar Jain | Deputy Director – Corporate Relations, MIT Academy of Engineering | Member |
| 13 | Dr. Sandeep Shewale | Head, Department of Chemical Engineering | Member |
| 14 | Dr. Dipti Sakhare | Head, Department of Electronics and Telecommunication Engineering | Member |
| 15 | Dr. Abhijeet Malge | Head, Department of Mechanical Engineering | Member |

| | | | |
|---|---|---|---|
| 16 | Dr. Puja Verma | Head, Department of Humanities and Engineering Science | Member |
| 17 | Mr. Avinash Bhalerao | Dean, School of Design | Member |
| 18 | Dr. Shyam Shukla | Head, Civil Engineering | Member |
| 19 | Dr. Pramod Ganjewar | Head, Department of Computer Engineering | Member |
| 20 | Mr. S. M. Bhagat | Registrar | Faculty Representative |
| 21 | Mrs. Ranjana Badre | Controller of Examinations | Faculty Representative |
| 22 | Dr. Suyogkumar Taralkar | IQAC Coordinator | Faculty Representative |
| 23 | Dr. Prachi Rajapallu | Associate Professor, Department of Electronics and Telecommunication | Faculty Representative |
| 24 | Mr. Dilip Panchal | Assistant Professor and Deputy Controller of Examination | Faculty Representative |
| 25 | Mr. Amar More | Assistant Professor, Department of Computer Engineering | Faculty Representative |

**2. Board of Studies Committee**

The Board of Studies of a Department in the college shall:

i. Prepare syllabi for various courses keeping in view the objectives of the college, interest of the stakeholders and national requirement for consideration and approval of the Academic Council.

ii. Suggest methodologies for innovative teaching and evaluation techniques;

iii. Suggest panel of names to the Academic Council for appointment of examiners; and

iv. Coordinate research, teaching, extension and other academic activities in the department/college. Board of studies of Computer Engineering at MIT Academy of Engineering is as below.

| **Sr. No.** | **Name** | **Role** | **Affiliation** |
|---|---|---|---|
| 1 | Dr. Pramod D. Ganjewar | Chairman | Associate Professor & HOD, Computer Engineering |
| 2 | Dr. Sunita S. Barve | Member | Professor & Dy. Director (Academics & Research) |
| 3 | Dr. Shitalkumar A. Jain | Member | Professor & Dy. Director (Corporate Relations & Placement Cell) |

| | | | |
|---|---|---|---|
| 4 | Dr. Rajeshwari M. Goudar | Member | Professor |
| 5 | Mrs. Ranjana Badre | Member | Associate Professor & Controller of Examination |
| 6 | Mr. Pramod Dharmadhikari | Member Secretary | Autonomy Coordinator |
| 7 | Mr. Anil Gupta | VC Nominee | Scientist, CDAC Pune |
| 8 | Dr. Vahida Attar | Academic Expert, Member | Associate Professor, Computer Department, COEP Technological University, Pune |
| 9 | Dr. Sunil Mane | Academic Expert, Member | Associate Professor, Computer Department, COEP Technological University, Pune |
| 10 | Mr. Abhijit Sarwade | Industry, Member | Johnson's Controller, Pune |
| 11 | Mr. Shailesh Giri | Industry, Member | Network Architect, Tech Mahindra, Pune |
| 12 | Mr. Aashish Shelar | Alumni Representative | Project Manager, IBM Pune |
| 13 | Dr. Kailas Patil | Expert from outside the college | Director, International Relations & Chief Information Security Officer, Vishwakarma University, Pune |
| 14 | Entire Faculty of Specialization | Faculty | Department of Computer Engineering |

**3. Internal Complaints Committee**

The Objectives of Internal Complaints Committee are as follows:

i. To evolve a permanent mechanism for prevention and redressal of sexual harassment cases and other acts of gender based violence at the institute.

ii. To develop a policy against sexual harassment of women at the Institute.

iii. To uphold the commitment of the institute to provide an environment free of gender based discrimination

| **Sr. No.** | **Name of the Member** | **Profile** | **Designation** |
|---|---|---|---|
| 1 | Mrs. Ranjana R. Badre | Senior Women Employee | Presiding Officer / Chairman |
| 2 | Dr. Vaishali Wangikar | Employee of the Institute | Member |
| 3 | Dr. Prafulla Hatte | Employee of the Institute | Member |
| 4 | Prof. S.A. Khandekar | Employee of the Institute | Member |
| 5 | Mrs. Carmel Pillay | Employee of the Institute | Member |
| 6 | Dr. Sunanda Phulari | Employee of the Institute | Member |

| | | | |
|---|---|---|---|
| 7 | Mr. Meghraj Suresh Tolnure | Student of the Institute | Member |
| 8 | Ms. Sneha Gurav Sadanand | Student of the Institute | Member |
| 9 | Ms. Mrunmayee Phadtare | Student of the Institute | Member |
| 10 | Mrs. Swati Londhe | Advocate | External Member |

**4. Examination Committee**

The powers and duties of the Examination committee

i. To ensure proper organization of various aspects of conduct of examinations namely paper setting, time table preparation, assessment and declaration of results.
ii. To prepare the detailed time table of examination as per the academic calendar approved by Dean Academics.
iii. To arrange for strict vigilance during the conduct of examinations in order to eliminate the use of unfair means by students, faculty and invigilators.
iv. To investigate and take disciplinary action for malpractices and lapses, connected with the conduct of the examinations. A sub-committee to be constituted for the same.
v. To prepare all formats for record keeping and monitoring of all examination related activities.
vi. To recommend examination reforms and implement them after approval of academic council examination Committee

| Sr. No. | Name of the Member | Profile | Designation |
|---|---|---|---|
| 1 | Dr. Y.J. Bhalerao | Director, MITAOE | Chairman |
| 2 | Prof. Ranjana Badre | Controller of Examination | Member Secretary |
| 3 | Dr. M.D. Goudar | Professor, Electrical Engineering | Chairman |
| 4 | Dr. Sunita Barve | Dy. Academic & Research | Member |
| 5 | Mr. Dilip Panchal | Dy. Controller of Examination | Member |

**5. Anti-Ragging Committee**

| Sl. No. | Name of the Members | Designation |
|---|---|---|
| 1 | Dr. Yogesh J. Bhalerao | Chairman |
| 2 | Col. (Retd.) Anand Bapat (abbapat@gmail.com) | Representative of Civil |
| 3 | Mr. Kurewad | Representative of Police (PSI, Local Police Station) |
| 4 | Mr. Vilas Kate | Representative of Local Media (Sakal Reporter, Alandi) |
| 5 | Dr. Mrs. Swatee Bapat (swateebapat@gmail.com) | Non-Government Organizations (Youth Activities) |
| 6 | Mr. Dhole (96237123612), Mr. Sallim Sayyad (9370053457) | Representatives of Parents |

| | | |
|---|---|---|
| 7 | Dr. M. D. Goudar, Dr. S. S. Barve, Dr. Sandeep Shevale, Prof. S. S. Lokhande, Prof. S. M. Bhagat, Prof. P. Hatte, Dr. A. M. Kotha, Prof. Ranjana Badre | Representatives of Faculty Members |
| 8 | Mr. Manoj Bade (Registrar) – Member Secretary, Dr. Ruby Barsaiya, Mr. U. R. Dhakane | Non-Teaching Staff |
| 9 | **Students (Sl.-Div-Roll No-Name-Mobile No):**<br>1. A - Pratik S. (7405871792)<br>2. B - 210 Vedant Lachake (9130554135)<br>3. C - Hussain S. (8956768751)<br>4. D - Divyansh<br>5. E - Kajale Rishikesh (8585860922)<br>6. F - Himanshu K. (9146848897)<br>7. G - Abhishek Patro (7285072156)<br>8. H - Sanket Jagtap (9146027945) | Representatives of Students (Freshers) |
| 10 | Mr. Saurabh Nevale, Ms. Neha Singh | Student Council Members |

### 6. Research & Development Committee

The Research and Development Committee shall have powers to:

i. Discuss and finalize R&D objectives. Communicate to all concerned. Initiate actions, monitor and analyze.
ii. Facilitate the submission of research proposals for funding through DRC & RRC.
iii. Collect and maintain the record of publications, research proposals and patents by faculty and students at institute level.
iv. Discuss R&D policies at institute level.
v. Recommend to the Governing Body proposals of institute for R&D policies and funding.
vi. Perform such other functions as may be assigned by the Governing Body.

| Sr. No. | Name of the Member | Profile | Designation |
|---|---|---|---|
| 1 | Dr. Sunita Barve | Dy. Director A & R, MIT Academy of Engineering | Chairman |
| 2 | Dr. Avinash Kamble | Associate Professor, Dept of Mechanical Engineering | Member |
| 3 | Dr. Preetam Kalod | Associate Professor, Dept of Mechanical Engineering | Member Secretary |
| 4 | Mrs. Mayura Kulkarni | Sr. Asst. Professor, Dept of Computer Engineering | Member |
| 5 | Dr. Parag Sutar | Assistant Professor, Dept of Chemical Engineering | Member |
| 6 | Dr. Suresh Hiremath | Assistant Professor, School of Humanities & Engineering Sciences | Member |

### 7. Students Welfare Committee

The student welfare committee shall have following roles and responsibilities:

**i.** Committee works for the welfare of the Students.

ii. The committee is responsible for making welfare schemes/Scholarships schemes/Code of conduct in the college.
iii. Arrange Medical Check-ups, Counselling sessions time to time for the students.
iv. Ensure the coordination between Students, Parents & College authority.
v. Ensure physical as well as mental health in the campus.

| Sr. No. | Name of the Member | Profile | Designation |
|---|---|---|---|
| 1 | Mr. S. A. Khandekar | Student Affairs | Chairman |
| 2 | Dr. Shitalkumar Jain | Professor, Dept of Computer Engineering | Faculty Member |
| 3 | Ms. Prachi Rajarapollu | Associate Professor | Faculty Member |
| 4 | Mr. Shailesh Gurav | Technical Assistant | Non-Teaching Staff & Member Secretary |
| 5 | Ms. Mayuri Pokarna | Technical Assistant, SMCE | Non-Teaching Staff |
| 6 | Mr. Saurabh Newale | President, Student Council, MITAOE | Student Representative |
| 7 | Ms. Tasneem Fatima | Ladies Representative, MITAOE | Student Representative |
| 8 | Mr. Prasoon Garg | Student Council Member | Student Representative |
| 9 | Mr. Shree Mane | Secretary, Student Council, MITAOE | Student Representative |

**8. Students Extracurricular Committee**

The student welfare committee shall have following roles and responsibilities:

i. Committee works for the overall development of student
ii. The committee is responsible for making necessary facilities available for student cultural, sports, technical as well as emotional and physical development.
iii. Making policies for student overall development.
iv. Making efforts for maximum student participation in extra and co-curricular activities and competitions.
v. Arranging various events and activities for student overall development.
vi. Strive for improving student satisfaction Index.
vii. Improving Alumni interaction for student's betterment.

| Sr. No. | Name of the Member | Profile | Designation |
|---|---|---|---|
| 1 | Mr. S. A. Khandekar | Student Affairs | Chairman |
| 2 | Mr. Atul Waghmare | Sports Director | Sports – Faculty |

| | | | |
|---|---|---|---|
| 3 | Ms. Mayuri Pokarna | Technical Assistant, Dept. of Mechanical Engg. | Cultural Club Head & Member Secretary |
| 4 | Dr. Diptee Sakhare | Associate Professor | Magazine Head |
| 5 | Mr. Husain Shaikh | Assistant Professor | NSS Head |
| 6 | Mrs. Savita Pawar | Sr. Asst. Professor | Technical Club Head |
| 7 | Mrs. Bhagyashri Alhat | Assistant Professor | Recreational Club Head |
| 8 | Mr. Pramod Kothmire | Assistant Professor | Alumni Head |
| 9 | Mr. Yash Deoghare | Sports Secretary, Student Council, MITAOE | Student Representative |
| 10 | Mr. Abhijit Gaikwad | Cultural Secretary, Student Council, MITAOE | Student Representative |
| 11 | Mr. Shubham Jathar | NSS Coordinator, Student Council | Student Representative |
| 12 | Ms. Neha Singh | Vice President, Student Council | Student Representative |
| 13 | Ms. Akanksha Sontakke | Student Council, MITAOE | Student Representative |
| 14 | Mr. Vedant Lachake | Student Council, MITAOE | Student Representative |

## 9. Internal Quality Assurance Cell

Roles and Responsibility of Internal Quality Assurance Cell members are stated below:

i. Development and application of quality benchmarks/parameters for various academic and administrative activities of the institution;
ii. Facilitating the creation of a learner-centric environment conducive to quality education and faculty maturation to adopt the required knowledge and technology for participatory teaching and learning process;
iii. Arrangement for feedback response from students, parents and other stakeholders on quality-related institutional processes;
iv. Dissemination of information on various quality parameters of higher education;
v. Organization of inter and intra institutional workshops, seminars on quality related themes and promotion of quality circles;
vi. Documentation of the various programmes/activities leading to quality improvement;
vii. Acting as a nodal agency of the Institution for coordinating quality-related activities, including adoption and dissemination of best practices;
viii. Development and maintenance of institutional database through MIS for the purpose of maintaining /enhancing the institutional quality;
ix. Development of Quality Culture in the institution;
x. Preparation of the Annual Quality Assurance Report (AQAR) as per guidelines and parameters of NAAC, to be submitted to NAAC.

| Sr. No. | Name | Designation |
|---|---|---|
| 01 | Prof. (Dr.) Yogesh J. Bhalerao | Chairman IQAC |

| | | |
|---|---|---|
| 02 | Prof. (Dr.) Shitalkumar A. Jain | Administration Officers |
| 03 | Prof. (Dr.) Sunita S. Barve | |
| 04 | Prof. Sunilkumar M. Bhagat | |
| 05 | Prof. (Dr.) Mahesh D. Goudar | |
| 06 | Prof. Avinash Bhalerao | Teachers Representative |
| 07 | Prof. (Dr.) Abhijit Malge | |
| 08 | Prof. Pooja Verma | |
| 09 | Mrs. Ranjana Badre | |
| 10 | Prof. (Dr.) Shayam Shukla | |
| 11 | Dr. Pramod Ganjewar | |
| 12 | Dr. Sandeep Shewale | |
| 13 | Prof. (Dr.) Dipti Sakhare | |
| 14 | Dr. Manish Giri | |
| 15 | Ms. Diptee Ghususe | |
| 16 | Dr. Vaishali Wangikar | |
| 17 | Dr. Santosh Warge | |
| 18 | Dr. Pritam Kalos | |
| 19 | Mr. Shridhar Khandekar | |
| 20 | Dr. Prachi Rajanpallu | |
| 21 | Dr. Sunanda Phulari | Staff Representatives |
| 22 | Prof. (Dr.) Balasaheb Waphare | Local Society Representatives |
| 23 | Prof. (Dr.) Anant Chakradeo | Management Representatives |
| 24 | Dr. Om Padmakar Shirkar | SY Student Representatives |
| 25 | Mr. Atharv Prakash Veerkar | TY Student Representatives |
| 26 | Ms. Manjiri Nandeshwekar | Girls Representatives |
| 27 | Mr. Chinmay Sanjeev Pokharkar | B.Tech Student Representatives |
| 28 | Mr. Kisan Pawar | Alumni Representatives |
| 29 | Mr. Hrishikesh Dhande | Industry Representatives |
| 30 | Prof. (Dr.) Suyogkumar Taralkar | IQAC – Coordinator |

**10. Academic and Administrative Audit Committee**

Roles and Responsibility Academic and Administrative Audit Committee is stated below:
Conduct Academic and Administrative Audit to monitor major objectives defined by the committee as follows:

i. To understand the existing system and assess the strengths and weaknesses of the Academic and Administrative Units and to suggest the methods for improvement and for overcoming the weaknesses.
ii. To identify the bottlenecks in the existing administrative mechanisms and to identify the opportunities for academic reforms, administrative reforms and examination reforms etc.
iii. To evaluate the optimum utilization of financial and other resources.

iv. To suggest the methods for continuous improvement of quality keeping in mind criteria and reports by NAAC and other bodies.

| Sr. No. | Name of the Member | Profile | Designation |
|---|---|---|---|
| 1 | Dr. Yogesh Bhalerao | Director, MIT Academy of Engineering | Chairman |
| 2 | Prof. S. M. Bhagat | Registrar, MIT Academy of Engineering | Member |
| 3 | Dr. M. D. Gaudar | Professor, MIT Academy of Engineering | Member |
| 4 | Dr. Sunita Barve | Dy. Director AR, MIT Academy of Engineering | Member |
| 5 | Dr. Shitalkumar Jain | Dy. Director CRPC, MIT Academy of Engineering | Member |
| 6 | Dr. S. V. Taralkar | IQAC Coordinator, MIT Academy of Engineering | Member |
| 7 | Dr. Prachi Rajarapollu | IQAC Co-Cordinator, MIT Academy of Engineering | Member |
| 8 | Discipline Specific Expert | Person from Renowned Institute | Member |
| 9 | Discipline Specific Expert | Person from Renowned Institute | Member |
| 10 | Discipline Specific Expert | Person from Renowned Institute | Member |

**11. College Development Committee**

Roles and Responsibility of College Development Committee is as follows:

i. Prepare an overall comprehensive development plan of the college regarding academic, administrative and infrastructural growth, and enable college to foster excellence in curricular, co-curricular and extra-curricular activities.
ii. Decide about the overall teaching programmes or annual calendar of the college.
iii. Recommend to the management about introducing new academic courses and the creation of additional teaching and administrative posts.
iv. Take review of the self-financing courses in the college, if any, and make recommendations for their improvement;
v. Make specific recommendations to the management to encourage and strengthen research culture, consultancy and extension activities in the college.
vi. Make specific recommendations to the management to foster academic collaborations to strengthen teaching and research.
vii. Make specific recommendations to the management to encourage the use of information and communication technology in teaching and learning process.
viii. Make specific recommendations regarding the improvement in teaching and suitable training programmes for the employees of the college.
ix. Prepare the annual financial estimates (budget) and financial statements of the college or institution and recommend the same to the management for approval.
x. Formulate proposals of new expenditure not provided for in the annual financial estimates (budget).
xi. Make recommendations regarding the students' and employees' welfare activities in the college or institution.

xii. Discuss the reports of the Internal Quality Assurance Committee & make suitable recommendations.
xiii. Frame suitable admissions procedure for different programmes by following the statutory norms.
xiv. Plan major annual events in the college, such as annual day, sports events, cultural events, etc.
xv. Recommend the administration about appropriate steps to be taken regarding the discipline, safety and security issues of the college or institution.
xvi. Consider and make appropriate recommendations on inspection reports, local inquiry reports, audit report, report of National Assessment and Accreditation Council, etc.
xvii. Recommend the distribution of different prizes, medals and awards to the students.
xviii. Prepare the annual report on the work done by committee for the year ending on the 30th June and submit the same to the management of such college and the university.
xix. Perform such other duties and exercise such other powers as may be entrusted by the management and the university.

| Sl. No. | Name of the Committee Member | Designation |
|---|---|---|
| 1 | Dr. Sanjay Dhande | Chairman |
| 2 | Dr. Anant Chakradeo | Management Nominee |
| 3 | Dr. Yogesh J Bhalerao | Member Secretary |
| 4 | Dr. Suyogkumar Taralkar | Dean QA / IQAC Coordinator |
| 5 | Dr. Mahesh D Goudar | Member |
| 6 | Mr. Sunilkumar Bhagat | Teacher |
| 7 | Dr. Shitalkumar Jain | Teacher |
| 8 | Dr. Sunita Barve | Teacher |
| 9 | Dr. Maya Charde | Women Teacher |
| 10 | Dr. Pritam Kalos | Teacher |
| 11 | Mr. Hitesh Lodha | Local Member (Alumni) |
| 12 | Dr. Balasaheb B. Waphare | Local Member (Education) |
| 13 | Shree Yashodhan Sakhare | Local Member (Social) |
| 14 | Dr. Sanjay P Kamble | Local Member (Research) |
| 15 | Mr. Pravin Pawar | Local Member (Industry) |
| 16 | Mr. Sunil Dewalwar | Elected Non-Teaching Employee |
| 17 | Harshvardhan Patil | President, Student Council |
| 18 | Ajay Shinde | Secretary, Student Council |
| 19 | Ms. Samruddhi Kakad | Ladies Representative, Student Council |

**12. Library Committee**

Roles and Responsibility of Library Committee members is as follows:

i. Library Committee is an advisory body to advise the Librarian on the policy matters of collection development of the Library. The policy matters on which they make recommendations
ii. To guide the Librarian in preparing forecast budget of Central Library.
iii. To be member of the purchase committee for Library Resources.

iv. To guide the Librarian in formulating collection development and selection policy of books, print and online journals. To consider policy matters regarding Central Library including the policy for procurement of books and journals and render advice to the Purchase Committee for Library procurements
v. All books and journals to be subscribed for the Library are scrutinized by the LC
vi. To support the Librarian in conduction library committee meetings.
vii. To review the requirements forwarded by the library of various department regarding requisition of books, journals and other educational materials.
viii. To support the Librarian in increasing users statistics in terms of faculty members and students as well.
ix. To support the librarian to weeding out / write off, books due to the un-serviceable, missing books, damage due to fire, water etc.
x. To approve the minutes of the meeting
xi. To support to solve major problems
xii. To encourage and motivate faculty members and students towards the optimal utilization of library resources.

**13. Disciplinary and Grievance Committee**

Roles and responsibility of Disciplinary and Grievance Committee members is as follows:

For in-disciplinary matters, the Disciplinary and Grievance Redressal Committee shall have powers to:

i. Monitor the disciplinary climate prevailing in the employees.
ii. Take preventive steps such as issue of notices, warnings, instructions regulating certain acts, and other arrangements for the purpose of forestalling acts of individual or collective indiscipline.
iii. Collect relevant facts about the incidents of indiscipline, evaluate the evidences. After looking into the relevant documents, discuss with those concerned.
iv. Submit the complete investigation report with evidences and recommendations to the Director and further to the Governing body.

**For redressal of grievance from any employee, the procedure is:**

1. The aggrieved member shall submit his/her petition to the Director in a sealed envelope marked "confidential".
2. On receipt of a petition, Director shall forward it to Disciplinary and Grievance Redressal Committee, if it is genuine.
3. Any grievance of general applicability or of collective nature of raised collectively by more than one employee shall not be considered. Only individual grievances of specific nature of employee raised individually by the concerned aggrieved employee of the institute shall be considered.

**After receiving grievance from Director, Disciplinary and Grievance Redressal Committee shall have powers to:**

1. Decide on the merit of case regarding scope of further discussion.
2. Study the petition/ application and after looking into the relevant documents discuss with those concerned and submit its recommendations and report to the Director as expeditiously as possible and further to the Governing body.
3. Committee may mediate between the complainant and defendant against whom the complaint has been made, if required.

The Director, as far as possible, shall be guided by the advice of the Grievance Redressal Committee unless the recommendations of Committee violate basic rules and norms of the Centre.

At least five members of the Grievance Committee shall be present in a meeting. If the aggrieved person happens to be a member of the Grievance Committee, then he/she shall not participate in the deliberations as a member of the Committee when his/her representation is being considered.

| Sr. No. | Name of Members | Profile | Designation |
|---|---|---|---|
| 1 | Dr. Mahesh Goudar | Officiating Director | Chairman |
| 2 | Dr. Abhijeet M. Malge | HOD, Mechanical Engineering | Member Secretary |
| 3 | Dr. Maya Charde | Associate Professor | Member |
| 4 | Dr. Shyam Shukla | HOD, Civil Engineering | Member |
| 5 | Mrs. Carmel Pillay | Deputy Registrar | Member |
| 6 | Mrs. Yogini Kendre | HR Manager | Member |
| 7 | Mrs. Mayuri Pokharna | Technical Assistant | Member |

**14. Caste Grievance Committee**

**Functions of the Caste Grievance committee is as follows:**

i. The Caste Grievance Committee will act as an advisory body to the Governing Body about:
   a. Prevention of the discrimination on the basis of castes and tribes.
   b. Redressal of the complaints raised by staff, students and faculties related to harassments on the basis of caste and tribes.
ii. Act as a mentor to build and maintain healthy relationship among the members of each and every caste and tribes.
iii. To ensure fear free environment for all backward category students, staffs and faculties.
iv. To give social justice to every caste and tribes.
v. To protect human rights of all backward category students, staffs and faculties.
vi. To encourage and make confident, all the backward category students, staffs and faculties.
vii. To counsel all the backward category students, staffs and faculties about their queries, doubts on the basis of castes and tribes.
viii. To protect all basic rights and duties of all backward candidates as per Constitution of India.
ix. To boost all-round development of all backward candidates in the campus.

| Name of the Committee Members | Profile | Designation |
|---|---|---|
| Prof. Maya M. Charde | Assistant Professor – SMCE | Chairman |
| Mr. Sunilkumar Bhagat | Registrar – MITAOE | Secretary |
| Dr. Abhijeet M. Malge | Dean – School of Engineering Design | Faculty Representatives |
| Prof. Mamta D. Sardare | Assistant Professor – SCET | Faculty Representatives |
| Dr. Shrikant V. Salve | Assistant Professor – SCET | Faculty Representatives |
| Mr. Atul Waghmare | Director of Physical Education and Sports | Student Representative |

| | | |
|---|---|---|
| Prof. Usha Y. Verma / Prof. Vaishali Wangikar | Dean Faculty and Staff / Dean Student Affairs | Director Representative |
| Mr. Namdeo S. Rashinkar | Technical Assistant – SMCE | Staff Representatives |
| Mrs. Nandini S. Phulpagar | Sr. Assistant – SESH | Staff Representatives |

**15. Admission-Hostel Committee**

Roles and Responsibilities Admission-hostel Committee is as follows:

i. To release the advertisement in the leading newspaper, Digital Marketing & Personal Visit.
ii. Identify and directly contact potential students through the data available on the Digital Marketing web portal.
iii. Visiting the key area to extract good students for admission
iv. Develop and distribute promotional materials such as a brochure.
v. Availability of Facility center for the students interested in engineering admission in the surrounding area.
vi. Uploading the instructions of admission procedure and fee details on the institute web portal.

| Sl. No. | Name | Designation |
|---|---|---|
| 1 | Mr. S. Pathare | Chairman |
| 2 | Dr. Sunita Barve | Nominated Member |
| 3 | Mr. Manoj Bade | Member Secretary |
| 4 | Mr. Amol Kapse | Member Faculty |
| 5 | Mrs. Carmel Pillay | Member |
| 6 | Mrs. V. C. Kulkarni | Member |

**16. Food and accommodation Committee**

Food and accommodation committee shall have powers to:

i. To taste and check the quality, cost, quantity of food served to the students.
ii. Make regulations regarding the admission of students to different hostels.
iii. Recommend to the IDC suggestions related to food variety to be served.
iv. Perform such other functions as may be assigned by the apex Body.

**17. Institution Development Committee**

Roles And Responsibility Institution Development Committee is as follows:

i. Prepare an overall comprehensive development plan of the college regarding academic, administrative and infrastructural growth, and enable College to foster excellence in curricular, co-curricular and extra-curricular activities.
ii. Decide about the overall teaching programs or annual calendar of the college.
iii. Recommend to the management about introducing new academic courses and the creation of additional teaching and administrative posts.
iv. Take review of the self-financing courses in the college, if any, and make recommendations for their improvement;
v. Make specific recommendations to the management to encourage and strengthen research culture, consultancy and extension activities in the college.

vi. Make specific recommendations to the management to foster academic collaborations to strengthen teaching and research.
vii. Make specific recommendations to the management to encourage the use of information and communication technology in teaching and learning process.
viii. Make specific recommendations regarding the improvement in teaching and suitable training programmes for the employees of the college.
ix. Prepare the annual financial estimates (budget) and financial statements of the college or institution and recommend the same to the management for approval.
x. Formulate proposals of new expenditure not provided for in the annual financial estimates (budget).
xi. Make recommendations regarding the students' and employees' welfare activities in the college or institution.
xii. Discuss the reports of the Internal Quality Assurance Committee & make suitable recommendations.
xiii. Frame suitable admissions procedure for different programmes by following the statutory norms.
xiv. Plan major annual events in the college, such as annual day, sports events, cultural events, etc.
xv. Recommend the administration about appropriate steps to be taken regarding the discipline, safety and security issues of the college or institution.
xvi. Consider and make appropriate recommendations on inspection reports, local inquiry reports, audit report, report of National Assessment and Accreditation Council, etc.
xvii. Recommend the distribution of different prizes, medals and awards to the students.
xviii. Prepare the annual report on the work done by committee for the year ending on the 30th June and submit the same to the management of such college and the university.
xix. Perform such other duties and exercise such other powers as may be entrusted by the management and the university.

**18. Finance Committee**:

The Finance Committee shall act as on advisory boy to the Governing Body to consider,

a) Budget estimates, income from fees etc. collected for the activities to undertake the scheme of autonomy ;and
b) Audited accounts for the above.

| Sr. No. | Names | Profile | Designation |
|---|---|---|---|
| 1 | Dr. Yogesh Bhalerao | Director, MIT Academy of Engineering | Chairman |
| 2 | Prof. Sunilkumar Bhagar | Registrar, MIT Academy of Engineering | Nominated by Governing Body of College |
| 3 | CA. Dr. M. A. Chordiya | Deputy Finance & Accounts Officer, SPPU | Finance Officer of the affiliating University |
| 4 | Dr. Mahesh Goudar | Professor, Department of E&TC, MIT Academy of Engineering | Senior-most Teacher of the College nominated by Director |
| 5 | CA Jyoti Potdar | Finance and Accounts Officer, MIT Academy of Engineering | Member Secretary |

| | | | |
|---|---|---|---|
| 6 | Mrs. Vishakha Kulkarni | Accounts Officer, MIT Academy of Engineering | Member |

**e. Methods/ Style of Administration/ Management**

MIT Academy of Engineering strongly believes that transparency in organizational hierarchy and awareness about the each one's responsibilities are paramount for any educational institute that wishes to go places. The governing body endorses the basic philosophy of governance. The roles, financial powers of the Director/Principal, School Deans and allied Deans are well defined and are made known to all.

**Principal controls**

(1) Director/Principal is responsible for entire academic, administrative governance of the institute.
(2) Head of the department look after school academics, formulation of Board of Studies, Conducting Academic Audits/Product Audits.
(3) The Head, Faculty and Students affairs who takes care of the vital spheres of administration like Human Resources.
(4) Dy. Director Administration looks after Accounts, Students section, Stores and Purchases and Hostel.
(5) Dy. Director Academics who ensures that the academics planning and monitoring of academics in institute.
(6) Dy. Director Corporate and his team includes, Director T & P takes care of the Training and Placement and Internship.
(7) R & D coordinator prerogative is to sensitize and motivate faculty and staff about research. He is supported by school R & D coordinators.
(8) IQAC Coordinator looks after ISO, IQAC, all types of accreditation and ranking processes of the institute.
(9) Head Students Affairs looks after students curricular/extracurricular activities/students clubs/Alumni.
(10) Controller of Examination is responsible of smooth conduction of examinations and publishing results.

## 10 Conceptual Master Plan for Off Campus Development

### a) The Site

The campus of MIT Academy of Engineering (OFF Campus) is located on the bank of 'Indrayani' river in the holy city Alandi, popularly known as Devachi Alandi (God's Place). The campus is spread over two pieces of land, one of ten acres and the other fifteen acres. The site is so located that there is greenery surrounding it with a serene atmosphere. It is located in a pollution free environment away from industrial city Pune by about 25 km. On the other bank of the Indrayani River there is samadhi and temple of the saint poet Dnyaneshwar which was built in the year 1570. This pilgrim center provides the spiritual dimension necessary for the personality development of the students.

MIT Academy of Engineering campus has entrance, through a 5 km. stretch from NH-10, Dehu Road towards south. The buildings are so planned that they are easily accessible from each other.

The site is well served by all the basic amenities like transportation, water supply, electricity, telephone, etc.

Alandi, a very historic and holy place is dominated with typical Maratha Hindu Architecture. Keeping this in view, all buildings reflect the same along with modernity. The plain off-white colour of buildings symbolizes the holiness of the area.

### b) Proposed Land Use Pattern

The campus is already fully developed on 4.08 acres of land,

Building-A with built up area of 9071 sq. meter dedicated to MIT ACSC.

Building-B with built up area of 14050 sq. meter dedicated to MIT Academy of Engineering (OFF Campus)

### c) Design Concept with proof of sustainability (As per Green Building Code 2017 is mandatory)

As one drives down the campus from Dehu-Alandi road, beautiful playground with greenery welcomes. The parking area is so located that the vehicular traffic will not disturb academic activities. Internal roads or pathways with beautiful landscaping interconnect all the buildings. While designing the buildings, principles of planning are given due consideration to a great extent.

**Aspect** means peculiarity of the arrangement of doors and windows in the external walls of a building, which allow the students to enjoy the natural gifts such as sunshine, breeze, scenery, etc.

**Privacy** is one of the important principles of planning in all types of buildings. Privacy required consideration in two ways.

a) Internal privacy: Internal privacy means screening interior of any one room from another rooms or parts. Privacy is of the supreme importance in bathroom, water closets and urinals.
b) External privacy: It means privacy of all parts of the building from neighboring buildings, public streets. This is achieved by properly planning entrances, raising compound walls, planting closely spaced tall trees.

**Roominess** refers to the effect produced by deriving maximum benefit from the minimum dimensions of the room. For giving better impression of roominess, the following points are kept in the view.

1) Suitable arrangement of rooms, doors and passages are made in such way that the utility, liability, privacy is not adversely affected.
2) A square room appears smaller in size than rectangular ones of same area. So planning of rooms is done as rectangular rooms.
3) Light colors create the effect of more roominess than dark colors. Therefore light colors are used for painting.

**Sanitation** consists of providing ample light, ventilation, facilities for cleaning and sanitary conveniences in the following manner.

**Light:** Light in the interior of building may be provided by natural or artificial lighting. Good lighting is necessary for all buildings. This has three primary aims. The first is to promote the work or other activities carried on within the building, second is to promote the safety of people using building, third is to create a sense of well-being in conjunction with structure and decoration.

**Ventilation**: Good ventilation is essentially required for comfort in buildings. Poor ventilation or lack of fresh air in building always produces headache, sleepiness, in ability to fix attention etc.

**Cleanliness and sanitary conveniences**: The prevention of dust is necessary in planning. The floors should be of non- absorbent surface, smooth and proper slope should be given to facilitate washing with suitable outlets in the walls. Sanitary conveniences include the provision of bathroom, water closets, lavatories, urinals, etc in sufficient number depending on the people occupying the building.

**Circulation** means access from one room to the adjoining room may be on same floor or on different floor.

1) Horizontal circulation means movement of the occupant of the same floor from one room to another room by making use of passages, verandahs, halls etc. It is desirable to have passages short, straight and sufficiently wide.

2) Vertical circulation means movement of the occupant from one floor to another floor. Staircases, lifts, escalators etc can achieve this. All stairs should satisfy the minimum requirement regarding rise, tread, width, landings, light and ventilation.

**Elegance** in its proper sense is the impression that the building is likely to make on a person who looks at it from the outside. Therefore, it includes the attainment of pleasing appearance by the use of natural beauties, deposition of doors and windows.

Elegance refers to the effect produce by the elevation of the structure. The elegance should be given due thought before the plan of any building is finalized. Elegance can be provided to a building by providing arches to the window opening, using decorative stones and different types of plasters on the front walls, proper landscaping for matching of structure with the surrounding.

**Grouping** means arranging various rooms in such a way that the functions of the rooms and movement of its users can be coordinated. Staircase is centrally located so that it is easily accessible from all parts of the building.

**Green Building** refers to the incorporation of environment friendly and resource efficient processes at each stage of construction, right from site selection and designing to construction, operation followed by maintenance, renovation or even demolition. In other terms, Green buildings are the structures that ensure efficient use of natural resources with minimal generation of non-degradable waste. If we compare regular building and green building then green building is one which uses less water, conserves more natural resources, generates less waste, optimizes energy efficiency and ultimately provides healthier space for occupants.

**d) Infrastructural Facilities in the Off-Campus**

The college campus consists of two buildings. The details of each building are as follows.

**Building-A:** It is a B+G+3 building mainly consisting of classrooms, laboratories, faculty rooms, computer centers, offices and various departments.

**Building-B:** It is a P+7 building mainly consisting of classrooms, laboratories, faculty rooms, computer centers, offices and various departments.

**e) Landscape Proposal.**

The entire campus is well developed by very good landscaping. The main entrance road is provided with tall trees on both sides to give a pleasant look. All open spaces are covered with green lawns and beautiful flower plants of different colors. All buildings are interconnected with pathways surrounded by green belts. The entire campus looks greenery and elegant

### 11.11 Requirement of Staff, Space, Equipment and their Cost

#### a) Introduction

It is proposed to start Computer Engineering (Off campus) program at **MIT Academy of Engineering** Alandi, the existing laboratories are sufficient for conducting the first year load (I and II semester) of the proposed Programme, as the syllabus for First Year is common to all branches of Engineering as per the curriculum of Savitribai Phule Pune University.

#### b ) Faculty and Staff Requirement

**i. Teaching Staff**

| Phase | Professor | Associate Professor | Assistant Professor | Total |
|---|---|---|---|---|
| I | 01 | 02 | 15 | 18 |
| II | 05 | 10 | 39 | 54 |
| III | | | | |
| IV | | | | |
| **Total Faculty** | **06** | **12** | **54** | **72** |

**ii. Non-teaching Staff requirement**

| Phase | Technical | Administrative | Peon | Total |
|---|---|---|---|---|
| I | 04 | 04 | 04 | 12 |
| II | 12 | 04 | 04 | 20 |
| III | | | | |
| IV | | | | |
| **Total** | **16** | **06** | **08** | **32** |

c) **Building Requirements: Area and Cost**

| Head | No of Div | 2026-27 Phase I | | 2027-28 Phase II | | 2028-29 Phase III | | 2029-2030 Phase IV | | Total | | Cost (Rs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No of rooms | Carpet Area(Sqm) | No of rooms | Carpet Area(Sqm) | No of rooms | Carpet Area(Sqm) | No of rooms | Carpet Area(Sqm) | No of rooms | Carpet Area(Sqm) | |
| Class room | 6 | 3 | 198 | 6 | 396 | 9 | 594 | 12 | 792 | 12 | 792 | 36,00,000/- |
| Laboratory | 6 | 8 | 528 | 16 | 1056 | 24 | 1584 | 32 | 2112 | 32 | 2112 | 1,00,00,000/- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| First Year Laboratory | 6 | 3 | 198 | -- | -- | -- | -- | -- | -- | 3 | 198 | 10,00,000/- |
| CAD Center | 6 | 1 | 132 | -- | -- | -- | -- | -- | -- | 1 | 132 | 6,00,000/- |
| Workshop | 6 | 1 | 200 | -- | -- | -- | -- | -- | -- | 1 | 200 | 10,00,000/- |
| Tutorial room | 6 | 1 | 33 | 2 | 66 | 3 | 99 | 4 | 132 | 4 | 132 | 6,00,000/- |
| Computer Center | 6 | 1 | 150 | -- | -- | -- | -- | -- | -- | 1 | 150 | 10,00,000/- |
| Seminar Hall | 6 | 1 | 132 | -- | -- | -- | -- | -- | -- | 1 | 132 | 6,00,000/- |
| Library | 6 | 1 | 400 | -- | -- | -- | -- | -- | -- | 1 | 400 | 20,00,000/- |
| Language lab | 6 | 1 | 33 | -- | -- | -- | -- | -- | -- | 1 | 33 | 4,00,000/- |
| Department Office | 6 | 4 | 80 | -- | -- | -- | -- | -- | -- | 4 | 80 | 5,00,000/- |
| Faculty rooms | 6 | 18 | 90 | 36 | 180 | 54 | 270 | -- | -- | 54 | 270 | 15,00,000/- |

d) **Estimated Cost of Equipment**

| **Sl. No.** | **Phase** | **Laboratory** | **Name of Equipment** | **Qty** | **Space(Sq mt)** | **Approximate cost (Rs.)** |
|---|---|---|---|---|---|---|
| 1 | I | Physics Laboratory | Law of Polygon Apparatus, Law of Moment Apparatus, Block Friction, Combined Coil & Flat, Belt Friction Apparatus, | 1 each | 66 | 5,30,507/- |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Centroid 1D & 2D, Projectile Motion Apparatus, Compound Pendulum Apparatus, Fly Wheel, Coefficient of Restitution Apparatus, Newton Ring, Malus Law setup, Laser | | | |
| 2 | | Chemistry Laboratory | Lab Equipment's | 39 | 66 | 2,04,000/- |
| | | | Lab Consumables | 473 | | 1,85,600/- |
| | | | Lab Chemicals | 2711 | | 52,900/- |
| 3 | | Electrical & Electronics Laboratory | Laboratory setup | 1 | 66 | 4,68,800/- |
| 4 | | Language Laboratory | Logitech H110 Headset | 50 | 33 | 37,500/- |
| 5 | | Computer Center | Printers, Computers | 3<br>50 | 100 | 4,37,696/-<br>80,00,000/- |
| 6 | | Workshop | Lahe, CNC, Drill Press, welding equipment, consumables | 1 each | 200 | 7,90,000/- |

**Phase-wise Financial Requirements**

| Phase | Space/Building/ Furniture | Salary | Library | Equipment's/Computers/ Software's | Total Cost in Rs. |
|---|---|---|---|---|---|
| I (2026-2027) | 86.96 Lakh | 30 Lakh | 17.50 Lakh | 107.00 Lakh | 241.46 Lakh |
| II (2027-2028) | 67.92 Lakh | 80 Lakh | 18.50 Lakh | 110 Lakh | 276.42 Lakh |
| III(2028-2029) | 101.88 Lakh | 130 Lakh | 18.00 Lakh | 100 Lakh | 349.88 Lakh |
| IV (2029-2303) | 121.44 Lakh | 200 Lakh | 19.00 Lakh | 80 Lakh | 420.44 Lakh |
| Total | 378.20 Lakh | 440 Lakh | 73 Lakh | 397 Lakh | 1288.20 Lakh |

e) **Strategies for Financial Mobilization**

The primary source of funds for the institute is the **tuition fees collected from students at the time of admission**. In addition, the promoting body, **MAEER, Pune**, along with the institute, possesses adequate financial resources to support infrastructure development and other requirements for launching Off-Campus.

An **annual budget for each department will be prepared well in advance of every financial year**, ensuring systematic allocation of resources. Both the promoting body and the institute maintain strong financial stability, guaranteeing that there will **no shortage of funds for academic, administrative, or developmental activities**.

## 12 Action Plan for Implementation

### a. Activity Chart

| Phase | Faculty / Staff Recruitment | Equipment Requirement | Books Procurement | Space Requirement |
|---|---|---|---|---|
| I | • Faculty / staff Requirement<br>• Advertisement<br>• Scrutiny<br>• Call Letters<br>• Interviews<br>• Appointments | • Purchase Orders for procurement of equipment are issued | • Requirement of Books<br>• Requisition for the books<br>• Purchase Order<br>• Receive the books | • Space for classroom, laboratories, tutorial room, office, workshop, computer center, CAD Center is identified and available as per requirement |
| II | • Faculty / staff Requirement<br>• Advertisement<br>• Scrutiny<br>• Call Letters<br>• Interviews<br>• Appointments | • Requirement of equipment Calling Quotations<br>• Comparative Statement<br>• Purchase Order<br>• Receive the Order | • Requirement of Books<br>• Requisition for the books<br>• Purchase Order<br>• Receive the books- | Building Construction in process |
| III | • Faculty / staff Requirement<br>• Advertisement<br>• Scrutiny<br>• Call Letters<br>• Interviews<br>• Appointments | • Requirement of equipment<br>• Calling Quotations<br>• Comparative Statement<br>• Purchase Order | • Requirement of Books<br>• Requisition for the books<br>• Purchase Order<br>• Receive the books- | • Construction of building - |

| | | | | |
|---|---|---|---|---|
| | | • Receive the Order | | |
| IV | • Faculty / staff Requirement<br>• Advertisement<br>• Scrutiny<br>• Call Letters<br>• Interviews<br>• Appointments | • Requirement of equipment<br>• Calling Quotations<br>• Comparative Statement<br>• Purchase Order<br>• Receive the Order | • Requirement of Books<br>• Requisition for the books<br>• Purchase Order<br>• Receive the books- | -Nil- |

a. **Constraints**

i. Recruitment of **qualified faculty and staff** within stipulated timelines.

ii. Provision for **digital connectivity and IT infrastructure** for blended learning.

b. **Financial Outlay**

Main source of funds will be tuition fees and the development fees collected from students at the time of admissions.

c. **Strategy for Implementation**

Strategy for Implementation will be as follows: -

1) As per the point 6.b faculties will be recruited for various posts.
2) As per the point 6.c non-teaching staff will be recruited for various posts.
3) As per the point 6.d various labs, Classrooms will be created in four phases.
4) As per the point 6.e various equipment's for various labs will be purchased in four phases.
5) As per the point 6.f and 6.g funds will be made available in different phases.

## 11.13 Executive Summary of the Detailed Project Report

### a) Details about the promoting body

Maharashtra Academy of Engineering and Educational Research's **(MAEER)** started its journey in 1983 to become India's one of the most respected and trusted Center of Excellence in the field of Education and Research. **MAEER Group** is celebrating its 40 glorious years of excellence in education field. MAEER is truly a multi-campus and multi-disciplinary organization conducting University approved academic programs in Engineering, Management, Pharmacy, Medicine, Art and Design, Social Science, Mass Communication Distance Education, Polytechnics and Schools. MAEER Group has total 71 Institutes imparting education in various fields. More than 1,00,000 students. More than 2000 well qualified & experienced faculty. More than 1000 acres of campus, with High-Tech laboratories equipped with R & D Infrastructure. 30 + Day Schools. Providing education from KG to PG Level. Having more than 50,000 alumni.

**Vision**

To promote the "Culture of Peace" through value based "Universal Education System", with a firm belief that "Union of Science and Religion / Spirituality alone will bring peace to mankind".

**Mission**

To harness the knowledge of Science & Technology for the welfare of the society.

### b) Name and Address of the Promoting Body:

| | | | |
|---|---|---|---|
| **Name** | MIT Academy of Engineering & Educational Research, Pune-38 | | |
| **Address** | S.No. 124, Ex-Servicemen Colony, Paud Road, Kothrud, Pune. | | |
| **Pin Code** | 411 038 | | |
| **STD Code** | 020 | **Phone No.** | 30253600, 30253500 |
| **Fax No.** | 020-25442770 | **E-Mail** | maealandi@mitpune.com |
| **Website** | www.mitaoe.ac.in | | |

### c) Date of Registration / Establishment of the Promoting Body:

Society Registration Act 1860 – Bombay Public Trust Act 1950

| | Society | Trust |
|---|---|---|
| **Registration Number** | Maharashtra / 1294 / Pune /83 | F –2555 |
| **Date of Registration** | June 21 st 1983 | October 24th 1983 |
| **Place of Registration** | Pune | Pune |

**d) Nature of the Promoting Body: Charitable**

**e) Activities of the Promoting Body Since Inception**

**Established in 1983,** Maharashtra Academy of Engineering **& Education Research (MAEER), Pune** is a renowned educational trust managing 25 institutions that offer education from Kindergarten to Postgraduate levels. MAEER is a truly multi-campus, multi-disciplinary organization conducting university-approved programs in **Engineering, Management, Pharmacy, Medicine, and Polytechnic**. At any given time, approximately **25,000 students** are enrolled across its institutions, representing a diverse cross-section of the country.

The trust emphasizes a **value-based education system**, fostering character building among the younger generation. In recognition of its contribution to education and society, **UNESCO has constituted a Chair in Human Rights, Democracy, and Peace** at MAEER's MIT campus. Additionally, a **World Peace Center** has been established to promote a global culture of peace. **MITAOE** offers multi-disciplinary, university-approved degree and postgraduate programs. The flagship institution, **Maharashtra Institute of Technology (MIT)**, was founded in 1983 as a premier engineering college. Over time, MAEER expanded into Management, Medicine, and Pharmacy education. MIT also offers a **Master's in Computer Science (MCS)** program in collaboration with the **University of Illinois, USA**, and maintains academic and research partnerships with **University of Aachen, Germany**, along with other German universities.

All MAEER institutions in Engineering, Management, Medicine, Pharmacy, and Polytechnic are located in **Pune – India's Education Hub**, while additional institutions, including a medical college and hospital, are situated in **Latur**, approximately 250 km from Pune. The campuses are equipped with modern infrastructure and qualified faculty. The Pune campus is a **fully e-enabled campus**, featuring over **400 computers connected via fiber-optic backbone networks**, server-client technology, and a **1 Mbps leased line through ERNET** for high-speed internet access.

MAEER maintains strong **industry-institute linkages**, ensuring an excellent placement record for its students in leading Indian and multinational companies. Its alumni network of approximately **2,000 professionals** spans the **US, Europe, Middle East, and Southeast Asia**, staying connected through the official website.

The Pune campus houses a dedicated library building with **five discipline-specific libraries**, comprising over **50,000 books**, national and international journals, and multimedia resources. Modern audio-visual facilities and high-speed internet access support research and literature surveys. Adequate hostel accommodation is available for both boys and girls across campuses, all of which are easily accessible via public transport.

Since its inception, **Maharashtra Academy of Engineering & Education Research (MAEER)** has earned a distinguished reputation in the field of education. Building on this legacy, MAEER plans to expand its footprint across diverse academic domains through its universities and specialized institutions:

**Universities and Academic Programs**

**1. MIT World Peace University, Pune**

- **Engineering (B.Tech):** Chemical, Polymer, Petroleum, Electrical, Mechanical, Robotics & Automation, Civil, Computer Engineering & Technology, Electronics & Communication
- **Design (B.Des):** Product Design, User Experience Design
- **Education:** Bachelor of Education (B.Ed.)
- **Management (BBA):** General, International Business, Computer Applications, Event Management, Global e-Business
- **Fine Arts, Media & Journalism:** BA in Mass Media, Photography, Film Studies & Production, Performing Arts (BPA)
- **Pharmacy:** B.Pharm
- **Commerce & Economics:** B.Com, B.Com (e-Commerce), B.Sc. (Economics)
- **Computer Science:** B.Sc. Computer Science, BCA

**2. Avantika University, Ujjain (MP)**

- School of Design, School of Business, School of Engineering, School of Architecture

**3. MIT Art, Design & Technology University, Pune**

- Schools of Engineering, Fine Arts, Bioengineering Sciences, Film & Television, Design, Architecture, Vedic Sciences, Naval Education, Food Technology, Education & Research

**4. MIT University, Meghalaya**

- BBA (Hospitality, Travel, Tourism, Finance, Retail)
- B.Tech (Cloud Computing, Virtualization Technology, Oil & Gas Informatics)

**Specialized Institutes**

- **Engineering:** MIT Academy of Engineering (Alandi), MIT College of Food Technology, MIT School of Advanced Science & IT
- **Management:** MITSOM College, MIT School of Government, MIT School of Business, MIT College of Management, MIT School of Retail Management, MIT School of Telecom & Management Studies
- **Medical:** Maharashtra Institute of Medical Sciences & Research (Latur), Maharashtra Institute of Medical Education & Research (Talegaon), Nursing Colleges, Physiotherapy, Dental Sciences
- **Education:** Multiple B.Ed. and D.Ed. Colleges across Maharashtra
- **Schools & Junior Colleges:** Spread across Pune, Latur, Beed, Aurangabad, Solapur, Ahmednagar

**Other Initiatives**

- **World Peace Center** – UNESCO Chair for Human Rights, Democracy, Peace, and Tolerance
- Strong focus on **industry-academia collaboration**, **global partnerships**, and **value-based education**.

The establishment of the **first UNESCO Chair in Human Rights, Democracy, and Peace** in the South Asian region at the **World Peace Center (Alandi)** of MAEER's MIT, Pune, marks a historic milestone in the Indian education system. This initiative reflects MIT's unwavering commitment to excellence—not only in **Engineering, Technology, Research, Management, and Environmental Sustainability**—but also in fostering **human values and global peace**. This remarkable journey of challenge, perseverance, and success has been driven by the visionary leadership of **Prof. Vishwanath D. Karad**, Founder Director of MIT, whose lifelong dedication to the cause of world peace, supported by a team of passionate educators, made this achievement possible.

The **World Peace Center (WPC)** undertakes significant initiatives, including a large-scale **Environmental Improvement and Pollution Control Project** along the banks of the Indrayani River at Alandi and Dehu, the sacred homes of Saints Shri Dnyaneshwar and Tukaram. WPC has also spearheaded national and international dialogues such as:

- **Indian Education System – Need for Change**
- **Parliament of Science, Religion, and Philosophy**
- **World Philosophers' Meet 1996**, inaugurated by **His Holiness the Dalai Lama**, Nobel Laureate.

Distinguished personalities like **Dr. Dumitru Chitoran**, Special Advisor to the Director General of UNESCO, have graced events such as the **Saint Dnyaneshwar and Saint Tukaram Endowment Lecture Series**.

The UNESCO Chair at WPC aims to **promote a culture of peace and human rights education**, integrating these values into curricula from **primary to postgraduate levels**. A dedicated **Research Wing in Peace Studies and Human Rights** collaborates with global institutions, NGOs, and government bodies to create a strong regional network for human welfare.

As every nation has its anthem, if the universe were to have one, it would undoubtedly be **"Pasaaydaan"**, the timeless prayer composed by Saint Dnyaneshwar—a true symbol of universal harmony.

### f) Constitution of the Promoting Body:

| Sr. No. | Name and Address of Trustees | Designation |
|---|---|---|
| 1 | Prof. Dr. Vishwanath D. Karad<br>'Dnyanmandir', Plot No.19, Rajpath Co-operative Hsg. Society, Ramkrishna Paramhansnagar, Paud Road, Kothrud, Pune - 411 038 | Founder Trustee and Chief Patron |
| 2 | Prof. Prakash B. Joshi<br>Sharmit Residency, Flat No.704, Sheela Vihar Colony, Karve Road, Pune - 411 038 | Founding Trustee and Patron |
| 3 | Prof. Rahul V. Karad<br>'Dnyanmandir', Plot No.19, Rajpath Co-operative Hsg. Society, Ramkrishna Paramhansnagar, Paud Road, Kothrud, Pune - 411 038 | Managing Trustee |
| 4 | Prof. Dr. Mangesh T. Karad<br>'Dnyanmandir', Plot No.19, Rajpath Co-operative Hsg. Society, Ramkrishna Paramhansnagar, Paud Road, Kothrud, Pune - 411 038 | Member Trustee |
| 5 | Shri. Tulshiram D. Karad<br>At & Post Rui-Rameshwar, Dist. Latur - 414 511 | Member Trustee |
| 6 | Dr. Suchitra U. Nagare<br>"Shriraj", Plot No.15, Rajpath Co-op. Housing Society, S. No.90/1B, Kothrud, Pune – 411 038 | Joint Managing Trustee |
| 7 | Dr. Sunil K. Karad<br>'Dnyanmandir', Plot No.19, Rajpath Co-operative Hsg. Society, | Member Trustee |

| | | |
|---|---|---|
| | Ramkrishna Paramhansnagar, Paud Road, Kothrud, Pune - 411 038 | |
| 8 | Smt. Kamal B. Avhad<br>'Dnyandeep' 19/1B/1, Near Sangam Press, Karve Road, Kothrud, Pune - 411 038 | Member Trustee |
| 9 | Dr. Virendra S. Ghaisas<br>1248/B, Ghaisas Hospital, Deccan Gymkhana, Pune - 411 004 | Member Trustee |
| 10 | Adv. Avinash B. Avhad<br>"Dnyandeep" 19/1B/1, Near Sangam Press, Karve Road, Kothrud, Pune - 411 038 | Member Trustee |
| 11 | Prof. Swati M. Chate | Member Trustee |
| 12 | Prof. Jyoti A. Dhakane | Member Trustee |
| 13 | Dr. Aditi R. Karad | Member Trustee |
| 14 | Mrs. Vidya P. Joshi | Member Trustee |
| 15 | Mr. Vinayak S. Ghaisas | Member Trustee |
| 16 | Shri. Ramesh K. Karad | Member Trustee Co-opted |
| 17 | Mrs. Pornima Nagargoje | Member Trustee Co-opted |
| 18 | Dr. Hanumant T. Karad | Member Trustee Co-opted |
| 19 | Mrs. Devika Ghaisas | Member Trustee Co-opted |

## 14 Faculty Data (Indentified)

| Sr. No. | Name | Academic Qualifications | Nature of Association with the Promoting Body | Experience in Academic Institutions (in years) |
|---|---|---|---|---|
| 1 | Dr. Suyogkumar Taralkar | PhD | Identified | 17 |
| 2 | Mrs. Priyanka Jadhav | ME | Identified | 9 |
| 3 | Mr. Jiten Patil | M. Tech | Identified | 20 |
| 4 | Dr. Poonam Lambhate | PhD | Identified | 26 |
| 5 | Mr. Aniket Bacchav | M Tech | Identified | 0 |
| 6 | Mr. Anil Pawar | M Tech | Identified | 3 |
| 7 | Mrs. Prajakta Jadhav | ME | Identified | 4.5 |
| 8 | Ms. Aarti Gavali | M Tech | Identified | 0 |
| 9 | Mr. Amitkumar Shinde | M. Tech | Identified | 3 |
| 10 | Mrs. Priyanka Nalawade | M. Tech | Identified | 4 |
| 11 | Mr. Manish Khare | MSc | Identified | 15 |
| 12 | Mr.Amit Sonawane | M. Tech | Identified | 14 |

| | | | | |
|---|---|---|---|---|
| 13 | Mrs. Seema Mandlik | M. Tech | Identified | 6 |
| 14 | Mr.Jayvant Devare | M. Tech | Identified | 10 |
| 15 | Mr.Mayur Patil | M. Tech | Identified | 11 |
| 16 | Mr.Hitesh Lodha | M. Tech | Identified | 12 |
| 17 | Mr.Sunil Mhamane | M. Tech | Identified | 13 |
| 18 | Ms. Ashwini Mane | M. Tech | Identified | 7 |
| 19 | Ms. Jayashree Kulkarni | M. Tech | Identified | 16 |
| 20 | Mr. Nilesh Bhandare | M. Tech | Identified | 7 |
| 21 | Farhana Shaikh | M. Tech | Identified | 9 |

## 15 Proposed Institution

a. Details about the Proposed Institution

**i) Category of Institution:** Engineering & Technology (Off Campus)

**ii) Name of the Proposed Programme:** Undergraduate-Engineering & Technology

**iii) Name of the Course:** Computer Engineering, Electronics and Telecommunication Engineering, Information Technology, Artificial Intelligence

**iv) Address of the Institution**

MIT Academy of Engineering (Off Campus),

Survey No. 123/1, 124/1/1, Choviswadi (Alandi Devachi), Taluka Khed,

District Pune – 412105, Alandi

Phone: - 020-30253500

**v) Nearest City / Town / Airport / Railway station**

| | | | |
|---|---|---|---|
| Nearest Rly Station | Pune | Distance in Kms (Towards) | 20 kms |
| Nearest Airport | Lohagaon, Pune | Distance in Kms (Towards) | 17 kms |

b. **Development Plan for the Proposed Institution:**

MIT Academy of Engineering is established in 1999. The Institute is already running 2 programmes of Engineering & Technology with 10 courses and Design which are already approved by AICTE, Government of Maharashtra and University of Pune.

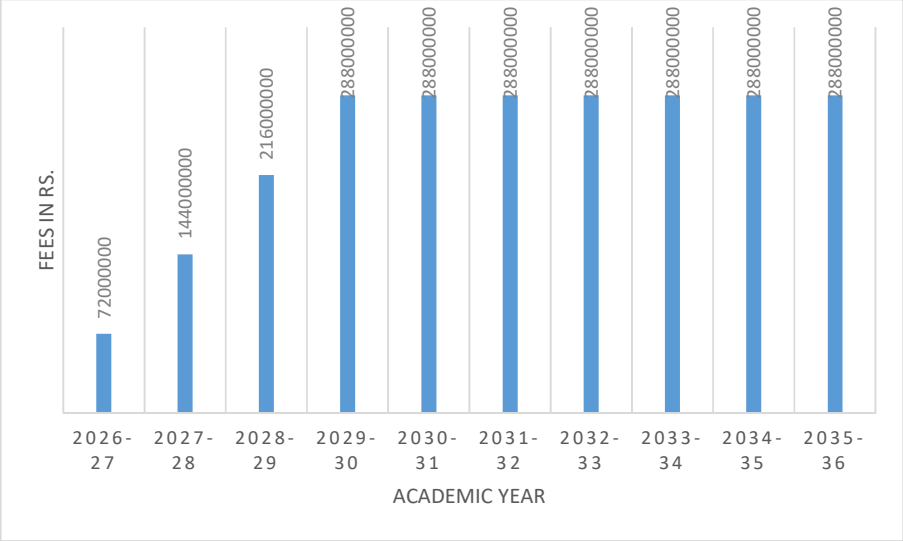
It is proposed to start the new off Campus programme of graduation in Engineering and Technology. For this proposed Programme the required developed land is already available with the Institute. Approach road for the campus is already developed and it is on the Alandi-Dehu road at Choviswadi (Alandi Devachi).

The sanctioned load by MSEB to the proposed Off-Campus is 596 KW/250 KVA. The Institute is also having an electricity generator with 265 KVA capacities as a backup. UPS facility will be also made available in all the buildings with total capacity 80 KVA.

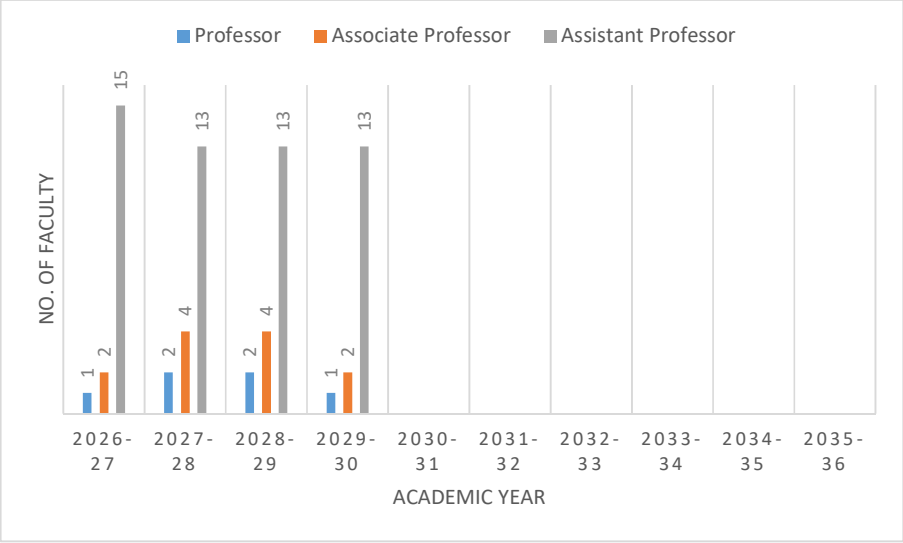
The proposed off-campus Institute is having Alandi Municipal Corporation water connection for supply of water to the whole campus including hostel. The Institute on its part treats the water for potable use.

**16 Graphical Representation**

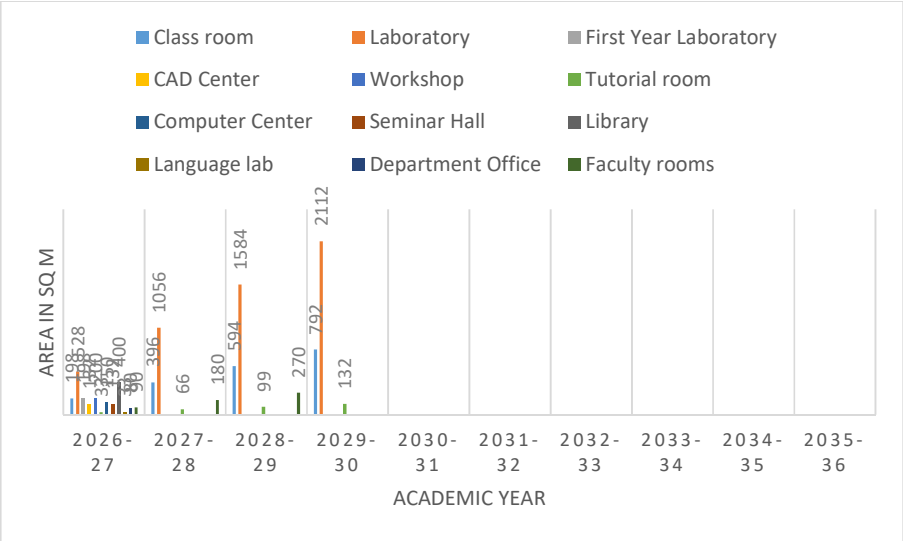
a Give a bar chart indicating mobilization of funds for the proposed project at the time of establishment and for next 10 years at intervals of five years.



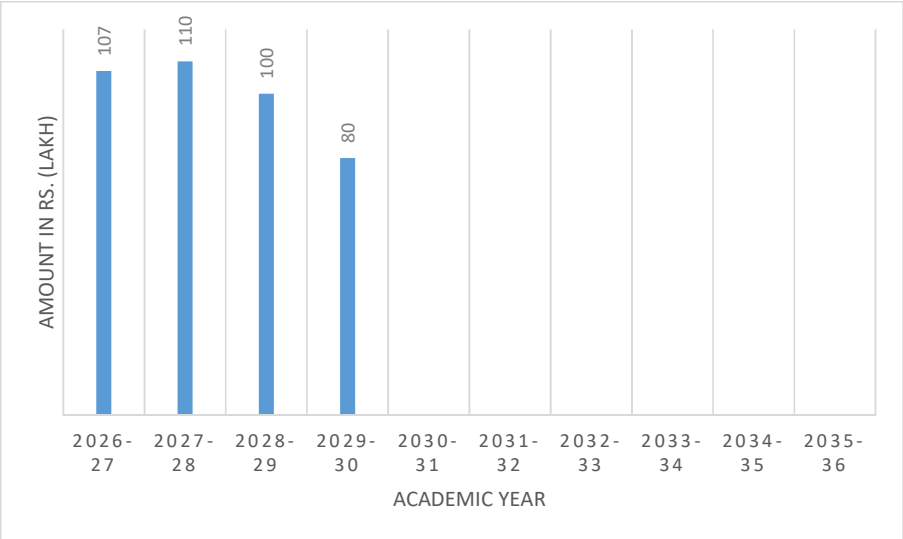

b Give a bar chart indicating the recruitment of faculty (separately for Lecturer, Assistant Professor, Associate Professor, Professor) for the proposed project at the time of establishment and for next 10 years at intervals of five years.



c Give a bar chart indicating creation of built-up area (separately for Instructional, Administrative and Amenities) for the proposed project at the time of establishment and for next 10 years at intervals of five years.




d Give a bar chart indicating investment on equipment and machinery for the proposed project at the time of establishment and for next 10 years at intervals of five years.




**17. Total Project cost (at the time of establishment and next five years)**

| Year | Courses/ Intake Proposed (I) | Built up area/ Investment to be made ( M²/ ₹ (II _) | Investment on Furniture and Accessories _) (₹ in Lakh (III ) | Investment on Equipment/ Machinery _) (₹ in Lakh (IV ) | Projected expenditure on Salary of Staff per annum (₹ in Lakh (V ) | Investment on Library (₹ in Lakh) VI | Total Project Cost I to VI) and Preoperative Exp.) (₹ in Lakh) |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2026-27 | UG-Computer Engg (120), E&TC Engg (120), IT (60), AI (60) | Existing | 86.96 | 107.00 | 30 | 17.50 | 241.46 |
| 2027-28 | | Existing | 67.92 | 110 | 80 | 18.50 | 276.42 |
| 2028-29 | | Existing | 101.88 | 100 | 130 | 18.00 | 349.88 |
| 2029-30 | | Existing | 121.44 | 80 | 200 | 19.00 | 420.44 |
| 2030-31 | | -- | -- | -- | --- | ---- | ---- |

**18. Details for mobilization/ source of funds (capital and recurring) (At the time of establishment and next five years) (₹ in Lakh)**

| Year | Donations | Grants from Government | Fee (Rs in Lakhs) | Loan | Others |
|---|---|---|---|---|---|
| 2026-27 | - | - | 720 | - | - |
| 2027-28 | - | - | 1440 | - | - |
| 2028-29 | - | - | 2160 | - | - |
| 2029-30 | - | - | 2880 | - | - |
| 2030-31 | - | - | 2880 | - | - |

**19. Recruitment of faculty (At the time of establishment and next five years)**

| Year | Professor | Associate Professor | Asst. Professor | Total |
|---|---|---|---|---|
| 2026-27 | 1 | 2 | 15 | 18 |
| 2027-28 | 2 | 4 | 13 | 19 |
| 2028-29 | 2 | 4 | 13 | 19 |
| 2029-30 | 1 | 2 | 13 | 16 |
| 2030-31 | -- | -- | -- | -- |

**. Recruitment of non-teaching staff (at the time of establishment and next five Years)**

| Year | Technical | Administrative | Peon | Total |
|---|---|---|---|---|
| 2026-27 | 04 | 04 | 04 | 12 |
| 2027-28 | 12 | 04 | 04 | 20 |
| 2028-29 | | | | |
| 2029-30 | | | | |
| 2030-31 | -- | -- | -- | -- |

**17. Structure of the governing body.**

| Sr. No. | Name of the Member | Profile | Designation |
|---|---|---|---|
| 1 | Dr. Sanjay Dhande | Padmashree Professor Sanjay Govind Dhande, former Director of IIT Kanpur, an innovative technologist, acclaimed academician, and institution builder | Chairman |
| 2 | Dr. Sunil Karad | Executive Director of MIT Group of Institutions; educationist, scholar, and visionary leader | Member |
| 3 | Prof. Anant Chakradeo | Dean of MIT Institute of Design and Director, International Relations for MIT Group of Institutions | Member |
| 4 | Dr. Yogesh Bhalerao | Recipient of 'Young Scientist Award from DST'; Director of MIT Academy of Engineering (MITAOE), Pune | Member Secretary |
| 5 | Dr. B.B. Ahuja | Director of College of Engineering, Pune (COEP) | Member |
| 6 | Prof. H.K. Abhyankar | Eminent academician; former Director of Vishwakarma Institute of Technology (VIT), Pune | Member |
| 7 | Dr. Sunil Bhagwat | Professor, Fergusson College, Pune | Member |
| 8 | Dr. N.S. Umrani | Former Pro-Vice Chancellor, Savitribai Phule Pune University (SPPU) | Invited Member |
| 9 | Dr. Mrs. Manju Singh | Secretary, University Grants Commission (UGC), Government of India | UGC Nominee |
| 10 | Dr. Aditya Abhyankar | Professor & Dean, Department of Technology, Savitribai Phule Pune University (SPPU) | Government of Maharashtra Nominee |
| 11 | Dr. Prashant Kumar | Indian Institute of Technology Kanpur | Member |
| 12 | Mr. Prakash Jagtap | Chairman and Managing Director, SAJ TEST PLANT PVT LTD | Member |
| 13 | Mr. Jiten Patil | Founder & Managing Partner, Quantum Orbit Consulting LLP | Member |
| 14 | Prof. B.P. Sabale | Ex-Vice Chancellor, YCMOU, Maharashtra | Member |
| 15 | Dr. Diptee Sakhare | Professor and HoD, Department of Electronics & Telecommunication Engineering | Member Faculty Representative |
| 16 | Dr. Suyogkumar Taralkar | Professor in Chemical Engineering and IQAC Coordinator | Member Faculty Representative |
| 17 | Mr. Amar More | Assistant Professor, School of Computer Engineering and Technology; Deputy Controller of Examination | Member Faculty Representative |

## 17. Industry Linkages (at the time of establishment, and next five years)

To address the dynamic needs of industry and stay aligned with emerging technologies, the Institute has established a dedicated **Industry-Institute Interaction Cell (IIIC)**. This cell serves as a strategic bridge between academia and industry, with the following key responsibilities:

1. **Campus Recruitment Programs** – Facilitating placement opportunities for students through strong industry partnerships.
2. **Internship and Training Initiatives** – Organizing summer and winter training programs across diverse industries for students of various disciplines.
3. **Knowledge Exchange Platforms** – Conducting guest lecture series, industrial visits, seminars, workshops, and conferences, while inviting industry experts for meaningful interaction.
4. **Alumni and Employer Feedback System** – Maintaining records of alumni and gathering employer feedback to continuously improve academic and training standards.
5. **Industry-Based Projects and In-Plant Training** – Enabling students to undertake final-year projects and hands-on training within leading industrial setups.
6. **Collaborative Agreements** – Signing **Memorandums of Understanding (MoUs)** with reputed national and international industries and research organizations to foster innovation and knowledge sharing.

**DECLARATION**

I/ We, on behalf of "**MIT Academy of Engineering (Off Campus)** "hereby confirm that this Detailed Project Report has been prepared for its proposed Technical Institution under the name and style of

a) **UG- Computer Engineering**
b) **UG-Electronics and Telecommunication Engineering**
c) **UG-Information Technology**
d) **UG-Artificial Intelligence**

It is hereby confirmed that all the information furnished above is true to the best of my/ our knowledge and belief and if any information is found to be false, the proposal shall be rejected.

Place: Pune

Date: 24/12/2025

Director

MIT ACADEMY OF ENGINEERING ALANDI (D), DIST. PUNE

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for Undergraduate Program Bachelor of Technology in Computer Engineering

(Choice Based Credit System)

**NEP REVISION**

(Four Year Curriculum W.E.F., AY: 2026-27 )

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## INSTITUTE VISION

**To be a new age learning center for holistic development of students into professional engineers, to cater to the changing needs of techno-society.**

## INSTITUTE MISSION

- **Providing new-age infrastructural facilities blended with skill-based curriculum and activity-based pedagogical approaches to develop competitive engineering professionals to solve real-world problems.**
- **Preparing students for lifelong learning by transforming educational practices.**
- **Promoting ethical and moral values by involving students in community services.**
- **Inculcating an entrepreneurship and managerial skills by strengthening industry-institute interaction.**

## COMPUTER ENGINEERING

## VISION

**To empower learners as leading computer engineers through a distinguished learning experience that fosters holistic development for achieving professional & academic excellence to pioneer the advancements in tech society.**

## MISSION

- **Providing students with the contemporary tools and resources to thrive in the competitive engineering field through comprehensive curriculum and effective pedagogy.**
- **Cultivating critical thinking, creativity, collaboration, and communication skills among learners to meet the demands of constantly evolving technologies.**
- **Inculcating ethical and moral values through community service involvement for positive societal impact.**
- **Nurturing entrepreneurial and managerial skills by strengthening industry-institute interaction.**

# PROGRAM EDUCATIONAL OBJECTIVES(PEO's)

| PEO | PROGRAM EDUCATIONAL OBJECTIVES(PEO's) |
|---|---|
| PEO1 | Computer engineering graduates will emerge as proficient and successful professionals, equipped with a solid foundation of computer engineering, adding invaluable technical expertise to the domain, playing integral roles in the design, development, deployment and production of cutting-edge computing systems and allied fields. |
| PEO2 | Graduates will possess the capability to address techno-socio-economic challenges by delivering automated solutions within core and multidisciplinary environments by utilizing the knowledge along with social, communicative, and ethical principles to contribute to positive societal outcomes through technological innovation. |
| PEO3 | Graduates will adeptly identify technological changes, demonstrate readiness to embrace new advancements in technology, refine both managerial and technical skills, and effectively collaborate on diverse projects while upholding human values. |

| PO | PROGRAM OUTCOMES (POs) |
|---|---|
| PO1 | **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| PO2 | **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| PO3 | **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations. |
| PO4 | **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| PO5 | **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| PO6 | **The Engineer and Society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| PO7 | **Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| PO8 | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| PO9 | **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| PO10 | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| PO11 | **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| PO12 | **Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

# PROGRAM SPECIFIC OUTCOMES(PSO's)

| PSO | PROGRAM SPECIFIC OUTCOMES (PSO's) |
|---|---|
| PSO1 | Design programming solutions for real-world applications to create innovative and efficient systems that address practical challenges in various domains. |
| PSO2 | Develop a systematic problem-solving approach, incorporating system design principles, and tailored to the precise requirements of the application domain. |
| PSO3 | Cultivate comprehensive professional competencies by integrating knowledge, technical skills, and a growth mindset to excel in the emerging areas of the global workplace. |

# MIT Academy of Engineering, Alandi, Pune

**An Autonomous Institute affiliated to Savitribai Phule Pune University**

## CURRICULUM FRAMEWORK (NEP Revision )

The Bachelor of Technology Program shall be based on the following type of courses.

| COURSE AND CREDIT DISTRIBUTION: SEMESTER WISE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.N. | TYPE OF COURSE | NO. OF COURSES/SEMESTER (CREDITS) | | | | | | | | Total Courses | Total Credits | % |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | |
| 1. | Basic Science Courses (BSC) | 2(7) | 2(8) | | | | | | | 4 | 15 | 9 |
| 2. | Engineering Science (ESC) | 2(6) | 3(8) | | | | | | | 5 | 14 | 9 |
| 3. | Program Core Course (PCC) | | 1(2) | 4(10) | 3(10) | 2(8) | 2(8) | 1(4) | 1(4) | 14 | 46 | 27 |
| 4. | Program Elective Course (PEC) | | | | | 1(4) | 1(4) | 1(4) | 1(3) | 4 | 15 | 9 |
| 5 | Vocational and Skill Enhancement Course (VSEC) | 1(2) | 1(2) | 1(2) | 1(2) | 1(2) | 1(2) | | | 6 | 12 | 7 |
| 6 | Multi-Disciplinary Minor(MDM) | | | | 1(3) | 1(3) | 1(3) | 1(2) | 1(3) | 5 | 14 | 8 |
| 7 | Open Elective (OE) | | | 1(4) | 1(2) | | | | 1(2) | 3 | 8 | 5 |
| 8 | Ability Enhancement Course (HSSM AEC) | 1(2) | | | | | 1(2) | | | 2 | 4 | 2 |
| 9 | Management/ Entrepreneurship/Economics Course (HSSM MEC) | | | 1(2) | | | | 1(2) | | 2 | 4 | 2 |
| 10 | Indian Knowledge System (HSSM IKS) & Co-curricular (CC) | 2(3) | 1(2) | | | | | | | 3 | 5 | 3 |
| 11 | Value Education Course (HSSM VEC) | | | 1(3) | 1(2) | | | | | 2 | 5 | 3 |
| 12 | Experiential Learning/ Project/ Field Work/ Community (ELC PRJ) | | | 1(1) | 1(1) | 1(2) | 1(2) | 2/1 (4/2) | 0/1 (0/2) | 6 | 10 | 6 |
| 13 | Experiential Learning Summer/ Semester Long Internship (ELC SI) | | | | 1(2) | 1(2) | | 1(4) | 1(8) | 4 | 16 | 10 |
| **Audit Courses** | | 1 | | | 1 | | | | | 2 | 0 | 0 |
| **TOTAL** | | 9 (20) | 8 (22) | 9 (22) | 9 (22) | 7 (21) | 7 (21) | 7 (20) | 5 (20) | 62 | 168 | 100 |

| CREDITS (CONTACT HOURS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 Lecture Hour = 1 Credit, 2 Lab Hours = 1 Credit, 1 Tutorial Hour = 1 Credit | | | | | | | |
| SL. NO. | YEAR | SEMESTER CREDIT | | | SEMESTER CONTACT HOURS | | |
| | | 1 | 2 | TOTAL | 1 | 2 | TOTAL |
| 1. | First Year | 20 | 22 | 42 | 29 | 29 | 58 |
| 2. | Second Year | 22 | 22 | 44 | 33 | 31 | 64 |
| 3. | Third Year | 21 | 21 | 42 | 27 | 31 | 58 |
| 4. | Final Year | 20 | 20 | 40 | 19(10) | 14 | 33(24) |
| TOTAL | | | | 168 | | | 213(204) |

| COURSE CATEGORIES ABBREVIATION | |
|---|---|
| BSC | Basic Science Course |
| ESC | Engineering Science Course |
| PCC | Programme Core Course |
| PEC | Programme Elective Course |
| MDM | Multi-Disciplinary Minor |
| OE | Open Elective |
| VSEC | Vocational and Skill Enhancement Course |
| HSSM AEC | Humanities Social Science Management Ability Enhancement Course |
| HSSM MEC | Humanities Social Science Management/Entrepreneurship/ Economics Course |
| HSSM IKS | Humanities Social Science Management Indian Knowledge System |
| HSSM VEC | Humanities Social Science and Management Value Education Course |
| ELC PRJ | Experiential Learning Course Project/ Field Work/ Community Engagement Project |
| ELC SI | Experiential Learning Course Student's Internship (Summer/ Semester Long/ Year Long) |
| CC | Co-Curricular Courses |

| ABBREVIATIONS | | | |
|---|---|---|---|
| TH | Theory Lecture | CA | Continuous Assessment |
| P | Practical Lab | T/P | Term Work / Practical |
| TU | Tutorial | DM | Demonstration |
| IA | Internal Assessment | Lab | Laboratory |
| MSE | Mid Semester Exam | | |
| ESE | End Semester Exam | | |

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## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# First Year

# Bachelor of Technology

# (Computer Engineering)

## NEP REVISION

(With Effect from Academic Year:2026-27 )

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F. | : | |
| FIRST YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: I (COMPUTER ENGINEERING)**

**Audit Course -2301119A Universal Human Values**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT/ TU | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/ P | | |
| BSC | 2301101T | Calculus and Differential Equations | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301101TU | Calculus and Differential Equations Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 |
| BSC | 2301102T | Engineering Physics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2301102L | Engineering Physics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2307101T | Electrical and Electronics Engineering | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2307101L | Electrical and Electronics Engineering Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2304101T | Foundations of Computing | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2304101L | Foundations of Computing Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| VSEC | 2304161T | Linux Fundamentals and Programming | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2304161L | Linux Fundamentals and Programming Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| HSSM AEC | 2301111L | Communication Skills (English) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2301112/3 /4T | Communication Skills (German/Japanese/French) | 2 | - | - | 35 | - | 40 | - | - | 75 | |
| CC | 2301182L | Liberal Learning | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| HSSM IKS | 2304181T | Indian Knowledge System (Vedic Mathematics) | 2 | - | - | 25 | - | 50 | - | - | 75 | 2 |
| **TOTAL** | | | **14** | **14** | **1** | | | | | | **800** | **20** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W.E.F | : | |
| FIRST YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| SEMESTER: II (COMPUTER ENGINEERING) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| BSC | 2301103T | Statistics and Integral Calculus | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2301103TU | Statistics and Integral Calculus Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 | |
| BSC | 2301104T | Science of Nature | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2301104L | Science of Nature Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ESC | 2304102T | Essentials of Data Science | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2304102L | Essentials of Data Science Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ESC | 2303101T | Applied Mechanics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2303101L | Applied Mechanics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ESC | 2309101T | Design Thinking | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 | |
| | 2309101L | Design Thinking Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 | |
| VSEC | 2304162T | Data Visualization | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 | |
| | 2304162L | Data Visualization Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 | |
| PCC | 2304111T | Discrete Structure | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| CC | 2307183L | Creative Technologies | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| TOTAL | | | 14 | 14 | 1 | | | | | | 850 | 22 | |

*Two Credits Internship needs to be completed after Completion of the First Year.

MIT | Academy of Engineering

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## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for
# Second Year
# Bachelor of Technology
# (Computer Engineering)

## NEP REVISION

(With Effect from Academic Year: )

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| SECOND YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: III (COMPUTER ENGINEERING)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304212T | Data Structures | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| PCC | 2304214L | Programming Lab | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| PCC | 2304221T | Computer Organization & Architecture | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2304221L | Computer Organization & Architecture Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| PCC | 2304218T | Computer Graphics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2304218L | Computer Graphics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| VSEC | 2304261L | Problem Solving Using Object Oriented Programming (C++) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2304262L | Problem Solving Using Object Oriented Programming (Java) | | | | | | | | | | |
| HSSM VEC | 2301287 | Universal Human Values-II | 1 | 4 | - | - | - | 25 | - | 75 | 100 | 3 |
| HSSM MEC | 2301276 | Entrepreneurship Skills | 1 | 2 | - | - | - | 25 | 20 | 30 | 75 | 2 |
| OE | 230125XT | Applied Mathematics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | *OE List | Open Elective Course | | | | | | | | | | |
| | 230125XL | Applied Mathematics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | *OE List | Open Elective Course Lab | | | | | | | | | | |
| ELC PRJ | 2304291L | Project Design | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| TOTAL | | | 11 | 22 | - | | | | | | 825 | 22 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| SECOND YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| SEMESTER: IV (COMPUTER ENGINEERING) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2304219T | Advanced Data Structures | 2 | - | - | 15 | 20 | 40 | - | - | 75 | | 2 |
| | 2304219L | Advanced Data Structures Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| PCC | 2304216T | Database Management System | 3 | - | - | 30 | 20 | 50 | - | - | 100 | | 3 |
| | 2304216L | Database Management System Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| PCC | 2304220T | Theory of Computation | 3 | - | - | 30 | 20 | 50 | - | - | 100 | | 3 |
| VSEC | 2304268L | Object Oriented Programming (Core Java) | - | 4 | - | - | - | - | 35 | 40 | 75 | | 2 |
| | 2304269L | Enterprise Application Development (Advanced Java) | | | | | | | | | | | |
| MDM | *MDM List | MDM Course-I | 2 | - | - | 15 | 20 | 40 | - | - | 75 | | 2 |
| | *MDM List | MDM Course-I Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| OE | 23BD251L | Prototyping | - | 4 | - | - | - | - | 35 | 40 | 75 | | 2 |
| | *OE List | Open Elective Course | 2 | - | - | 35 | | 40 | - | - | | | |
| HSSM VEC | 2301286T | Environmental Science | 2 | - | - | 35 | - | 40 | - | - | 75 | | 2 |
| ELC PRJ | 2304292L | Project Implementation | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| ELC SI | 2304296L | Internship (Life And Soft Skills) | - | - | - | - | - | - | - | 75 | 75 | | 2 |
| Audit | 2301281A | Indian Constitution | 1 | - | - | - | - | - | - | - | Audit | | |
| TOTAL | | | 15 | 16 | - | | | | | | 850 | | 22 |

*Two Credit Internships need to be completed after Completion of the Second Year.

MIT | Academy of Engineering

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## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for
# Third Year
# Bachelor of Technology
# Computer Engineering

## NEP REVISION

(With Effect from Academic Year: )

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| THIRD YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: V (COMPUTER ENGINEERING)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT/TUT | | TOTAL | |
| | | | L | P | T | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304311T | Operating Systems | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304311L | Operating Systems Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2304312T | Computer Networks | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304312L | Computer Networks Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PEC | 2304321T | Exploratory Data Analytics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304322T | Artificial Intelligence Machine Learning | | | | | | | | | | |
| | 2304323T | Cloud Computing Foundation | | | | | | | | | | |
| | 2304324T | Cryptography and Information Security | | | | | | | | | | |
| | 2304321L | Exploratory Data Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2304322L | Artificial Intelligence Machine Learning Lab | | | | | | | | | | |
| | 2304323L | Cloud Computing Foundation Lab | | | | | | | | | | |
| | 2304324L | Cryptography and Information Security Lab | | | | | | | | | | |
| VSEC | 2304361L | Linux Administration-I | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2304362L | Web Technology | | | | | | | | | | |
| | 2304363L | Mobile Application Development | | | | | | | | | | |
| | 2304364L | UI/UX Design | | | | | | | | | | |
| MDM | *MDM List | Multi Disciplinary Minor Course-II | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | *MDM List | Multi Disciplinary Minor Course-II Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ELC PRJ | 2304391L | Major Project - I | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2304396L | Summer Internship (Technical) | - | - | - | - | - | - | - | 75 | 75 | 2 |
| **TOTAL** | | | **11** | **16** | **-** | | | | | | **800** | **21** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| THIRD YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: VI (COMPUTER ENGINEERING)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | CREDIT |
| | | | L | P | T | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304313T | Software Engineering | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304313L | Software Engineering Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2304314T | Design & Analysis of Algorithms | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304314L | Design & Analysis of Algorithms Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PEC | 2304326T | Predictive Analytics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304327T | Deep Learning | | | | | | | | | | |
| | 2304328T | Cloud Native Application Development | | | | | | | | | | |
| | 2304329T | Cyber Security & Forensics | | | | | | | | | | |
| | 2304326L | Predictive Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2304327L | Deep Learning Lab | | | | | | | | | | |
| | 2304328L | Cloud Native Application Development Lab | | | | | | | | | | |
| | 2304329L | Cyber Security & Forensics Lab | | | | | | | | | | |
| VSEC | 2304366L | Linux Administration-II | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2304367L | Cloud Services | | | | | | | | | | |
| | 2304368L | Practitioners's Approach to AI | | | | | | | | | | |
| | 2304369L | Web and Desktop Application Development | | | | | | | | | | |
| | 2304370L | Natural Language Processing | | | | | | | | | | |
| MDM | *MDM List | Multi Disciplinary Minor Course-III | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | *MDM List | Multi Disciplinary Minor Course-III Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| HSSM AEC | 2301371L | Employability and Career Development | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC PRJ | 2304392L | Major Project - II | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| **TOTAL** | | | **11** | **20** | **-** | | | | | | **800** | **21** |

*Four Credit Internship needs to be completed after Completion of the Third Year

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# Final Year

# Bachelor of Technology

# Computer Engineering

## NEP REVISION (NEP)

(With Effect from Academic Year: )

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: VII (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304411T | System Design | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 2304421T | Big Data Analytics | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2304422T | Generative AI Applications | | | | | | | | | | |
| | 2304423T | Cloud Native DevOps | | | | | | | | | | |
| | 2304424T | Ethical Hacking & Cyber Laws | | | | | | | | | | |
| | 2304421L | Big Data Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2304422L | Generative AI Applications Lab | | | | | | | | | | |
| | 2304423L | Cloud Native DevOps Lab | | | | | | | | | | |
| | 2304424L | Ethical Hacking & Cyber Laws Lab | | | | | | | | | | |
| MDM | *MDM List | Multidisciplinary Minor Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| HSSM MEC | 2304476T | Project Management | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2304491L | Major Project - III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC PRJ | 2304492T | Research Methodology | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC SI | 2304496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| **TOTAL** | | | **13** | **6** | **-** | | | | | | **750** | **20** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: VIII (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304412T | Cyber Security | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 230442XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2304SWXX | SWAYAM Course* | - | - | - | 25 | - | 75 | - | - | | |
| MDM | *MDM List | MDM Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 23XXSWXX | SWAYAM Course (MDM)* | - | - | - | 25 | | 75 | - | - | | |
| OE | 2301451L | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2304497L | Semester-Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 2304498L | Student Outreach Program | - | - | - | - | - | - | | | | |
| | 2304493L | Capstone Portfolio | - | - | - | - | - | - | | | | |
| TOTAL | | | 10 | 4 | | | | | | | 725 | 20 |

*Credits earned in advance through a credit transfer scheme

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| SEMESTER: VII (PART B) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304411T | System Design | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| MDM | *MDM List | Multidisciplinary Minor Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2304491L | Major Project - III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2304499L | Industry Practicum | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| ELC SI | 2304496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| TOTAL | | | 6 | 4 | - | | | | | | 750 | 20 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: VIII (PART B)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304412T | Cyber Security | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 230442XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2304SWXX | SWAYAM Course* (PEC) | - | - | - | 25 | - | 75 | - | - | | |
| MDM | *MDM List | MDM Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 23XXSWXX | SWAYAM Course* (MDM) | - | - | - | 25 | | 75 | - | - | | |
| OE | 2301451L | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2304497L | Semester-Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 2304498L | Student Outreach Program | - | - | - | - | - | - | | | | |
| | 2304493L | Capstone Portfolio | - | - | - | - | - | - | | | | |
| TOTAL | | | 10 | 4 | | | | | | | 725 | 20 |

*Credits earned in advance through a credit transfer scheme

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W.E.F | : | |
| EXIT CRITERIA BACHELOR OF TECHNOLOGY | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| Name of the Program | Exit after | Courses | Credits | Total |
|---|---|---|---|---|
| Computer Engineering | FIRST YEAR | Database Management Systems | 4 | 8 |
| | | Internship | 4 | |
| | SECOND YEAR | Software Engineering | 4 | 8 |
| | | Internship | 4 | |
| | THIRD YEAR | Human Computer Interactions | 4 | 8 |
| | | Internship | 4 | |

| Basic Science Courses (BSC): 4 Courses and 15 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301101T | Calculus and Differential Equations | 3 |
| | 2301101TU | Calculus and Differential Equations Tutorial | 1 |
| 2. | 2301102T | Engineering Physics | 2 |
| | 2301102L | Engineering Physics Lab | 1 |
| 3. | 2301103T | Statistics and Integral Calculus | 3 |
| | 2301103T | Statistics and Integral Calculus Lab | 1 |
| 4. | 2301104T | Science of Nature | 3 |
| | 2301104L | Science of Nature Lab | 1 |

| Engineering Science (ESC):5 Courses and 14 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2307101T | Electrical and Electronics Engineering | 2 |
| | 2307101L | Electrical and Electronics Engineering Lab | 1 |
| 2. | 2304101T | Foundations of Computing | 2 |
| | 2304101L | Foundations of Computing Lab | 1 |
| 3. | 2304102T | Essentials of Data Science | 2 |
| | 2304102L | Essentials of Data Science Lab | 1 |
| 4. | 2303101T | Applied Mechanics | 2 |
| | 2303101L | Applied Mechanics Lab | 1 |
| 5. | 2309101T | Design Thinking | 1 |
| | 2309101L | Design Thinking Lab | 1 |

| Program Core Course (PCC): 14 Courses and 46 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2304111T | Discrete Structure | 2 |
| 2. | 2304212T | Data Structures | 3 |
| 3. | 2304214L | Programming Lab | 2 |
| 4. | 2304221T | Computer Organization & Architecture | 1 |
| | 2304221L | Computer Organization & Architecture Lab | 1 |
| 5. | 2304218T | Computer Graphics | 2 |
| | 2304218L | Computer Graphics Lab | 1 |
| 6. | 2304219T | Advanced Data Structures | 2 |
| | 2304219L | Advanced Data Structures Lab | 1 |
| 7. | 2304216T | Database Management System | 3 |
| | 2304216L | Database Management System Lab | 1 |
| 8. | 2304220T | Theory of Computation | 3 |
| 9. | 2304311T | Operating Systems | 3 |
| | 2304311L | Operating Systems Lab | 1 |
| 10. | 2304312T | Computer Networks | 3 |
| | 2304312L | Computer Networks Lab | 1 |
| 11. | 2304313T | Software Engineering | 3 |
| | 2304313L | Software Engineering Lab | 1 |
| 12. | 2304314T | Design & Analysis of Algorithms | 3 |
| | 2304314L | Design & Analysis of Algorithms Lab | 1 |
| 13. | 2304411T | System Design | 4 |
| 14. | 2304412T | Cyber Security | 4 |

| Program Elective Course (PEC): 4 Courses and 15 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2304321T | Exploratory Data Analytics | 3 |
| | 2304322T | Artificial Intelligence Machine Learning | |
| | 2304323T | Cloud Computing Foundation | |
| | 2304324T | Cryptography and Information Security | |
| | 2304321L | Exploratory Data Analytics Lab | 1 |
| | 2304322L | Artificial Intelligence Machine Learning Lab | |
| | 2304323L | Cloud Computing Foundation Lab | |
| | 2304324L | Cryptography and Information Security Lab | |
| 2. | 2304326T | Predictive Analytics | 3 |
| | 2304327T | Deep Learning | |
| | 2304328T | Cloud Native Application Development | |
| | 2304329T | Cyber Security Forensics | |
| | 2304326L | Predictive Analytics Lab | 1 |
| | 2304327L | Deep Learning Lab | |
| | 2304328L | Cloud Native Application Development Lab | |
| | 23043229L | Cyber Security Forensics Lab | |
| 3. | 2304421T | Big Data Analytics | 3 |
| | 2304422T | Generative AI Applications | |
| | 2304423T | Cloud Native DevOps | |
| | 2304424T | Ethical Hacking & Cyber Laws | |
| | 2304421L | Big Data Analytics Lab | 1 |
| | 2304422L | Generative AI Applications Lab | |
| | 2304423L | Cloud Native DevOps Lab | |
| | 2304424L | Ethical Hacking & Cyber Laws Lab | |
| 4. | 2304SWXX | SWAYAM Course | 3 |

| List of SWAYAM Courses | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2304SW01 | SWAYAM Course | 3 |
| 2 | 2304SW02 | SWAYAM Course | |
| 3. | 2304SW03 | SWAYAM Course | |
| 4. | 2304SW04 | SWAYAM Course | |
| 5. | 2304SW05 | SWAYAM Course | |

| Vocational and Skill Enhancement Course (VSEC): 6 Courses and 12 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2304161L | Linux Fundamentals and Programming | 2 |
| 2. | 2304162L | Data Visualization | 2 |
| 3. | 2304261L | Problem Solving Using Object Oriented Programming (C++) | 2 |
| | 2304262L | Problem Solving Using Object Oriented Programming (Java) | |
| 4. | 2304268L | Object Oriented Programming (Core Java) | 2 |
| | 2304269L | Enterprise Application Development (Advance Java) | |
| 5. | 2304361L | Linux Administration-I | 2 |
| | 2304362L | Web Technology | |
| | 2304363L | Mobile Application Development | |
| | 2304364L | UI/UX Design | |
| 6. | 2304366L | Linux Administration-II | 2 |
| | 2304367L | Cloud Services | |
| | 2304368L | Practitioner’s Approach to AI | |
| | 2304369L | Web and Desktop Application Development | |
| | 2304370L | Natural Language Processing | |

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| Open Elective (OE): 3 Courses and 8 Credits | | | | |
|---|---|---|---|---|
| **Sl. No.** | **Offering School** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | SHES (Mathematics) | 2301251T | Applied Mathematics | 3 |
| | | 2301251L | Applied Mathematics Lab | 1 |
| | | 2301252T | Applied Mathematics | 3 |
| | | 2301252L | Applied Mathematics Lab | 1 |
| | | 2301253T | Applied Mathematics | 3 |
| | | 2301253L | Applied Mathematics Lab | 1 |
| | | 2301254T | Applied Mathematics | 3 |
| | | 2301254L | Applied Mathematics Lab | 1 |
| | | 2301255T | Applied Mathematics | 3 |
| | | 2301255L | Applied Mathematics Lab | 1 |
| | | 2301256T | Applied Mathematics | 3 |
| | | 2301256L | Applied Mathematics Lab | 1 |
| | | 2301257T | Applied Mathematics | 3 |
| | | 2301257L | Applied Mathematics Lab | 1 |
| 2. | B. Design | 23BD251L | Prototyping | 2 |
| 3. | SHES | 230145XXL | Professional Certification Course | 2 |

| Humanities Social Science and Management Ability Enhancement Courses (HSS AEC): 2 Courses and 4 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301111/2/3/4 | Communication Skills (English/ German/Japanese/French) | 2 |
| 2. | 2301371L | Employability and Career Development | 2 |

| Humanities Social Science Management/Entrepreneurship/Economics (HSS MEC): 2 Courses and 4 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301276 | Entrepreneurship Skills | 2 |
| 2. | 2304476T | Project Management | 2 |

| Humanities Social Science and Management Value Education Course (HSSM VEC): 3 Courses and 5 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301119A | Universal Human Values-I | Audit |
| 2. | 2301286T | Environmental Science | 2 |
| 3. | 2301287 | Universal Human Values-II | 3 |

| Humanities Social Science and Management Indian Knowledge System / Co-Curricular Courses (HSSM IKS / CC): 4 Courses and 5 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2304181T | Indian Knowledge System - (Vedic Mathematics) | 2 |
| 2. | 2301182L | Liberal Learning - (HSSM CC) | 1 |
| 3. | 2307183L | Creative Technologies - (HSSM CC) | 2 |
| 4. | 2301281A | Indian Constitution | Audit |

| Experiential Learning Course Project/Field Work/Community Project(ELC PRJ): 6 Courses and 10 Credit | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2304291L | Project Design | 1 |
| 2. | 2304292L | Project Implementation | 1 |
| 3. | 2304391L | Major Project - I | 2 |
| 4. | 2304392L | Major Project - II | 2 |
| 5. | 2304491L | Major Project - III | 2 |
| 6. | 2304492T | Research Methodologies | 2 |
| (Optional) | 2304493L | Capstone Portfolio | 8 |

| Experiential Learning Course Student's Internship (Summer/Semester Long) (ELC SI): 4 Courses and 16 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2304296L | Internship (Life And Soft Skills) | 2 |
| 2. | 2304396L | Summer Internship (Technical) | 2 |
| 3. | 2304496L | Summer Internship (Technical) | 4 |
| 4. | 2304497L | Semester Long Internship | 8 |
| (Optional) | 2304498L | Student Outreach Program | 8 |
| (Optional) | 2304499L | Industry Practicum | 8 |

| Multi-Disciplinary Minor (MDM) List: 05 Courses and 14 Credits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Programme Name | Track Name | Semester IV (MDM-I, 3 Credits) | | Semester V (MDM-II, 3 Credits) | | Semester VI (MDM-III, 3 Credits) | | (MD |
| | | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Cours Code |
| Chemical Engineering | Chemical Engineering (Green Technology and Sustainability Engineering) | 2301232 (T+L) | Engineering Informatics (T+L) | 2305331 (T+L) | Sustainability & Green Technology (T+L) | 2305332 (T+L) | Sustainable Bio-energy and Bio-products (T+L) | 230543 |
| | Chemical Engineering (Industrial Technology Management) | 2301232 (T+L) | Engineering Informatics (T+L) | 2305333 (T+L) | Management of Technology (T+L) | 2305334 (T+L) | Product Management (T+L) | 230543 |
| Civil Engineering | Civil Engineering (Infrastructure and Sustainability | 2301232 (T+L) | Engineering Informatics (T+L) | 2303331 (T+L) | Smart Cities (T+L) | 2303332 (T+L) | Sustainable Engineering (T+L) | 230343 |
| Computer Engineering | Computer Engineering | 2301232 (T+L) | Engineering Informatics (T+L) | 2304331 (T+L) | Data Structures & Algorithms (T+L) | 2304332 (T+L) | Database Management Systems (T+L) | 230443 |
| Software Engineering | Software Engineering | 2301232 (T+L) | Engineering Informatics (T+L) | 2310331 (T+L) | Software Architecture (T+L) | 2310332 (T+L) | Software Testing (T+L) | 231043 |
| Computer Science & Engineering (AIML) | Artificial Intelligence and Machine Learning | 2301232 (T+L) | Engineering Informatics (T+L) | 2311331 (T+L) | Artificial Intelligence & Machine Learning (T+L) | 2311332 (T+L) | Deep Learning (T+L) | 231143 |
| | Healthcare Technologies | 2301232 (T+L) | Engineering Informatics (T+L) | 2311333 (T+L) | Fundamentals of Healthcare Technologies (T+L) | 2311334 (T+L) | Healthcare Informatics (T+L) | 231143 |
| Computer Science & Engineering (DS) | Data Science | 2301232 (T+L) | Engineering Informatics (T+L) | 2312331 (T+L) | Data Analytics (T+L) | 2312332 (T+L) | Predictive Analytics (T+L) | 231243 |

| Multi-Disciplinary Minor (MDM): 05 Courses and 14 Credits | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Programme Name | Track Name | Semester IV (MDM-I, 3 Credits) | | Semester V (MDM-II, 3 Credits) | | Semester VI (MDM-III, 3 Credits) | | Semester VII (MDM-IV, 2 Credits) | | Semester VIII (MDM-V, 3 Credits) | |
| | | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name |
| Information Technology | Cloud Computing | 2301232 (T+L) | Engineering Informatics (T+L) | 2308331 (T+L) | Cloud Computing Foundations (T+L) | 2308332 (T+L) | Cloud-Native Application Development (T+L) | 2308431T | Cloud Native DevOps | 2308SWXX | SWAYAM Course |
| Electronics Engineering | Blockchain Technologies | 2301232 (T+L) | Engineering Informatics (T+L) | 2306331 (T+L) | Cyber Security Essentials (T+L) | 2306332 (T+L) | Network Security (T+L) | 2306431T | Blockchain Technology Applications | 2306SWXX | SWAYAM Course |
| Mechanical Engineering | Computer Aided Engineering and Automation | 2301232 (T+L) | Engineering Informatics (T+L) | 2309331 (T+L) | CAD Automation and Customisation (T+L) | 2309332 (T+L) | Computer Aided Simulation (T+L) | 2309431T | Industrial Automation | 2309SWXX | SWAYAM Course |
| SHES (Entrepreneurship) | Innovation and Entrepreneurship | 2301232 (T+L) | Engineering Informatics (T+L) | 2301331 (T+L) | Foundation of Entrepreneurship (T+L) | 2301332 (T+L) | Venture Development | 2301431T | Startup Incubation & Fund Raising | 2301SWXX | SWAYAM Course |
| MITACSC | Business Administration | 2301232 (T+L) | Engineering Informatics (T+L) | 2301333 (T+L) | Principles and Practices of Management (T+L) | 2301334 (T+L) | Organizational Behavior | 2301432T | Managerial Economics | 2301SWXX | SWAYAM Course |
| SHES | Lean Management | 2301232 (T+L) | Engineering Informatics (T+L) | 2301335 (T+L) | Foundations of Lean Manufacturing Process | 2301336 (T+L) | Advance Lean manufacturing | 2301433T | Lean Manufacturing Project | 2301SWXX | SWAYAM Course |
| B. Design | Design for Engineers | 2301232 (T+L) | Engineering Informatics (T+L) | 23BD331 (T+L) | Design Fundamentals | 23BD332 (T+L) | Packaging Design | 23BD431T | Introduction to UI-UX | 23BDSWXX | SWAYAM Course |

# MIT Academy of Engineering, Alandi, Pune

**An Autonomous Institute affiliated to SavitribaiPhule Pune University**

## PROGRAMME OBJECTIVES

# COMPUTER ENGINEERING

The program's goal is to provide a professionally guided education in Computer Engineering that prepares graduates to transition into a broad range of career options: industry, government, computing graduate program, and professional education.

Within four years of completion, graduates exhibit the following characteristics:

1. Demonstrates agility in solving software and system challenges with a comprehensiveset of skills appropriate to the needs of the dynamic global computing-based society.
2. Capable of diverse team and organizational leadership in computing project settings.
3. Demonstrates ethical principles in the application of computing-based solutions to societal and organizational problems.
4. Continually acquires skills and knowledge to support a professional pathway, including communication, analytic, and technical skills.

**Examination Manual**

(Excerpt from the Examination Manual)

## 10. The Grading System

i) For every course taken by a student he/she is assigned a grade based on his/her performance in all the assessments including ISE, IA and ESE. Performance is first quantified as marks and then assigned letter grades

The grade indicates a qualitative assessment of the student's performance and is associated with an equivalent number called a grade point.

ii) The academic performance shall be graded on a 10 point scale. The letter grades and their equivalent grade points are listed in Table II.

iii) The Absolute grading system is followed, grades are allotted as per the Table below

| Grades | Range of Marks | Grade Points | Description |
|---|---|---|---|
| AA | 80-100 | 10 | Outstanding |
| AB | 70-79 | 9 | Excellent |
| BB | 60-69 | 8 | Very good |
| BC | 55-59 | 7 | Good |
| CC | 50-54 | 6 | Satisfactory |
| CD | 45-49 | 5 | Average |
| DD | 40-44 | 4 | Marginal |
| FF | 00-39 | 0 | Fail (Permitted to repeat ESE) |
| XX | | -- | Detained (Re register for the course) |
| NP | | -- | Absent for the examination |

| | | | |
|---|---|---|---|
| | | | (Permitted to repeat ESE) |
| PP | | -- | Completed the Audit Course successfully |
| NN | | -- | Not completed the audit course |

Table II : The grading System

iii) The letter grades (up to DD only) awarded to a student in all the courses shall be converted into a semester and cumulative grade point average to be calculated following the procedure given in section 10.2.

**The Grading Process**

i) The marks of the ISE, IA and ESE will be used to decide the total marks for each student. If the total has a fractional part then it shall be rounded off to the next integer.

ii) The grades will then be assigned to each student.

iii) The grades will be then examined and verified by the Examination Moderation committee.

**Performance Indices**

**Calculation of Semester Grade Point Average (SGPA)**

The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the Semester.

$$SGPA = \frac{\sum_{i=1}^{n} CiPi}{\sum_{i=1}^{n} Ci}$$

Where,

Ci= The number of credits earned in the ith course of a semester for which SGPA is to be calculated.

Pi=Grade point earned in the ith course i=1, 2, ..... , n represent the number of courses in which a student is registered in the concerned semester

The SGPA is calculated to two decimal places.

**Calculation of Cumulative Grade point Average (CGPA)**

An up-to-date assessment of the overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is the weighted average of the grade points obtained in all the courses in prescribed semesters for the UG/PG Programs. CGPA for a student of undergraduate/postgraduate Programs shall be calculated only when the grade point (minimum up to pass marks) of all the semester examinations is available.

$$CGPA = \frac{\sum_{j=1}^{N} CjPj}{\sum_{j=1}^{N} Cj}$$

Where,

Cj =The number of credits earned in the jth course up to the semester for which CGPA is to be calculated.

Pj =Grade point earned in the jth course. A grade point less than 4 in a undergraduate course shall not be taken into consideration for calculation of CGPA.

j = 1, 2, ..... , m represent the number of courses in which a student is registered up to the semester for which the CGPA is to be calculated.

The CGPA is also calculated to two decimal places.

**Guidelines for the Award of Grades:**

The following are the general guidelines for the award of grades:

i) For each student, all evaluations in different components of a course shall be done in absolute marks considering the weight-age in teaching scheme.

ii) The marks of various components shall be added to get total marks secured on a 10-points scale. The rounding off shall be done on the higher side.

iii) An Examination moderation committee will be responsible for examining and analyzing the results.

iv) The course in-charge, course faculty and Grade moderation committee's decision regarding grade thresholds and grade allotment will be final.

Explanation for Grades

**i) Passing Grades** -The grades AA, AB, BB, BC, CC, CD and DD are passing grades. A candidate acquiring any one of these grades in a course shall be declared as passed. A student shall earn the credits for a course only if the student gets passing grade in that course.

**ii) FF Grade**

a) Letter grade FF in any course implies failure in that course.

b) A student who was awarded "FF" grade in a course has to repeat it compulsorily when it is offered next and until a passing grade is obtained.

**iii) The Transitional Grades NP and XX shall be awarded in the followingcases:**

a) Grade NP to a student only on satisfactory attendance at classes and performance in other components of assessment, but absence from ESE/ECE in a semester for valid and convincing reasons acceptable to the Department, such as,

a. Illness or accident, which disabled him/her from appearing at the examination;
b. A calamity in the family at the time of the examination, which required the student to be away from the College;

b) Grades XX to a student on his/her overall performance in the course during the semester. This grade will be awarded to a student who is detained in that particular course.

**iv)** Both the SGPA and CGPA shall be rounded off to the second place of decimal and recorded as such for ease of presentation. Whenever the CGPAs are to be used for the purpose of determining the merit ranking in a group of students, only the rounded off values shall be made use of.

**v)** A student is considered to have completed a course successfully and earned the credits if he/she secures a letter grade other than NP, XX or FF in that course.

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# First Year

# Bachelor of Technology

# (Computer Engineering)

## NEP REVISION

(With Effect from Academic Year: )

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F. | : | |
| FIRST YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: I (COMPUTER ENGINEERING)**

**Audit Course -2301119A Universal Human Values**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT/ TU | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/ P | | |
| BSC | 2301101T | Calculus and Differential Equations | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301101U | Calculus and Differential Equations Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 |
| BSC | 2301102T | Engineering Physics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2301102L | Engineering Physics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2307101T | Electrical and Electronics Engineering | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2307101L | Electrical and Electronics Engineering Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2304101T | Foundations of Computing | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2304101L | Foundations of Computing Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| VSEC | 2304161T | Linux Fundamentals and Programming | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2304161L | Linux Fundamentals and Programming Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| HSSM AEC | 2301111L | Communication Skills (English) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2301112/3 /4T | Communication Skills (German/Japanese/French) | 2 | - | - | 35 | - | 40 | - | - | 75 | |
| CC | 2301182L | Liberal Learning | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| HSSM IKS | 2304181T | Indian Knowledge System (Vedic Mathematics) | 2 | - | - | 25 | - | 50 | - | - | 75 | 2 |
| **TOTAL** | | | **14** | **14** | **1** | | | | | | **800** | **20** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W.E.F | : | |
| FIRST YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| SEMESTER: II (COMPUTER ENGINEERING) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| BSC | 2301103T | Statistics and Integral Calculus | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2301103U | Statistics and Integral Calculus Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 | |
| BSC | 2301104T | Science of Nature | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2301104L | Science of Nature Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ESC | 2304102T | Essentials of Data Science | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2304102L | Essentials of Data Science Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ESC | 2303101T | Applied Mechanics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2303101L | Applied Mechanics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ESC | 2309101T | Design Thinking | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 | |
| | 2309101L | Design Thinking Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 | |
| VSEC | 2304162T | Data Visualization | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 | |
| | 2304162L | Data Visualization Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 | |
| PCC | 2304111T | Discrete Structure | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| CC | 2307183L | Creative Technologies | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| TOTAL | | | 14 | 14 | 1 | | | | | | 850 | 22 | |

*Two Credits Internship needs to be completed after Completion of the First Year.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** - 2024 (Rev. (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Calculus and Differential Equations |
| | **COURSE CODE** | 2301101T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301101T.CEO.1: To apply the concepts of partial differentiation.
2301101T.CEO.2: Demonstrate an understanding towards the applications of partial differentiation.
2301101T.CEO.3: Examine methods for solving first-order first-degree ordinary differential equations.
2301101T.CEO.4: Infer the applications of first-order differential equations.
2301101T.CEO.5: Determine the solution of linear differential equations of second and higher order.
2301101T.CEO.6: Solve first-order linear and nonlinear partial differential equations.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301101T.CO.1: Make use of properties of partial differentiation to solve the problems [L3].
2301101T.CO.2: Examine the applications of partial differentiation [L4].
2301101T.CO.3: Solve first-order and first-degree ordinary differential equations [L2].
2301101T.CO.4: Analyze real-world phenomenon governed by first-order ordinary differential equations [L4].
2301101T.CO.5: Apply concepts of solving linear differential equations of second and higher order governing different systems in engineering [L4].
2301101T.CO.6: Determine solutions of various partial differential equations by theoretical methods [L3].

## COURSE ABSTRACT

The course focuses on developing important mathematical concepts in a comprehensible, coherent and rigorous way. This is achieved by means of a carefully balanced approach by including the topics of calculus and differential equations which will foster the analytical thinking, and problem solving abilities of the students. Students are encouraged to apply their mathematical knowledge to solve problems and clear their doubts through tutorial sessions. Students embarking on this course will be able to identify and solve various differential equation problrms and will be intellectually equipped with the links between these concepts and their core engineering and real life problems. This course will enable them to tackle the problems of differential equations that they encounter in other engineering courses.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Partial Differentiation** | **08 HOURS** |

**Contents:** Partial Differentiation: Introduction, Chain rule, Total derivative, Change of variables, Homogeneous functions, Euler's theorem, Differentiation of implicit functions.
**Self Study:** Differentiation of implicit functions.

| | | |
|---|---|---|
| **UNIT 2** | **Applications Of Partial Differentiation** | **07 HOURS** |

**Applications/Case Study:** Maxima, Minima.
**Contents:** Jacobian, Jacobian of implicit functions, Partial derivative of an implicit function using Jacobians, Functional dependence, Maxima and Minima of functions of two variables.
**Self Study:** Jacobian of implicit functions.

| | | |
|---|---|---|
| **UNIT 3** | **Ordinary Differential Equations Of First Order And First Degree** | **07 HOURS** |

**Contents:** Exact differential equations, Differential equations, Reducible to exact form-Integrating factors, Linear differential equations, Differential equations reducible to linear form.
**Self Study:** Differential equations reducible to linear form.

| | | |
|---|---|---|
| **UNIT 4** | **Applications Of Ordinary Differential Equations Of First Order & First Degree** | **07 HOURS** |

**Applications/Case Study:** Electrical circuits.
**Contents:** Orthogonal trajectories, Newton's law of cooling, Growth & Decay, Electric circuits, Chemical applications- Mixing problems.
**Self Study:** Newton's law of cooling, Growth & Decay.

| | | |
|---|---|---|
| **UNIT 5** | **Linear Differential Equation Of Second Order & Higher Order** | **08 HOURS** |

**Applications/Case Study:** Mass-Spring systems.
**Contents:** General solutions of linear differential equations with constant coefficients,Shortcut methods to find P.I., Method of variation of parameters, Equations reducible to linear differential equations with constant coefficients: Cauchy and Legendre's linear differential equations.
**Self Study:** Cauchy and Legendre's linear differential equations.
**Further Readings:** Simultaneous differnetial equations, Applications in Electric circuits, Mass-Spring systems etc.

| UNIT 6 | Partial Differential Equations | 08 HOURS |
|---|---|---|

**Contents:** Introduction and formation of a partial differential equation, solution of a partial differential equation, equations solvable by direct integration, Linear differential equations of the first order, Non-linear differential equations of the first order, Charpit's method.

**Further Readings:** Linear Homogeneous Partial Differential Equations.

## TEXT BOOKS


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.
2. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.


## REFERENCE BOOKS


1. Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379-8858). Addison-Wesley.
2. Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.
3. Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.
4. O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.
5. Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Calculus and Differential Equations Tutorial |
| | COURSE CODE | 2301101U |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 1 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301101U.CEO.1: To apply the concepts of partial differentiation.
2301101U.CEO.2: Demonstrate an understanding towards the applications of partial differentiation.
2301101U.CEO.3: Examine methods for solving first-order first-degree ordinary differential equations.
2301101U.CEO.4: Infer the applications of first-order differential equations.
2301101U.CEO.5: Determine the solution of linear differential equations of second and higher order.
2301101U.CEO.6: Solve first-order linear and nonlinear partial differential equations.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301101U.CO.1: Make use of properties of partial differentiation to solve the problems [L3].
2301101U.CO.2: Examine the applications of partial differentiation [L4].
2301101U.CO.3: Solve first-order and first-degree ordinary differential equations [L2].
2301101U.CO.4: Analyze real-world phenomenon governed by first-order ordinary differential equations [L4].
2301101U.CO.5: Apply concepts of solving linear differential equations of second and higher order governing different systems in engineering [L4].
2301101U.CO.6: Determine solutions of various partial differential equations by theoretical methods [L3].

## COURSE ABSTRACT

The course focuses on developing important mathematical concepts in a comprehensible, coherent and rigorous way. This is achieved by means of a carefully balanced approach by including the topics of calculus and differential equations which will foster the analytical thinking, and problem solving abilities of the students. Students are encouraged to apply their mathematical knowledge to solve problems and clear their doubts through tutorial sessions. Students embarking on this course will be able to identify and solve various differential equation problrms and will be intellectually equipped with the links between these concepts and their core engineering and real life problems. This course will enable them to tackle the problems of differential equations that they encounter in other engineering courses.

| **TUTORIALS** | | |
|---|---|---|
| **TUTORIAL NO.01** | **Partial Differentiation** | **01 HOUR** |
| Problems On Partial Differentiation: Introduction, Chain rule, Total derivative, Change of variables. | | |
| **TUTORIAL NO.02** | **Partial Differentiation** | **01 HOUR** |
| Problems On Homogeneous functions, Euler's Theorem, Differentiation of Implicit functions. | | |
| **TUTORIAL NO.03** | **Applications of Partial Differentiation** | **01 HOUR** |
| Problems on Jacobian, Jacobian of Implicit functions, Partial derivative of an implicit function. | | |
| **TUTORIAL NO.04** | **Applications of Partial Differentiation** | **01 HOUR** |
| Problems on Functional dependence, Maxima and Minima of functions of two variables. | | |
| **TUTORIAL NO.05** | **Ordinary Differential Equations** | **01 HOUR** |
| Problems on Exact differential equations, Differential equations reducible to exact form-Integrating factors. | | |
| **TUTORIAL NO.06** | **Ordinary Differential Equations** | **01 HOUR** |
| Linear differential equations, Differential equations reducible to linear form. | | |
| **TUTORIAL NO.07** | **Applications of Ordinary Differential Equations** | **01 HOUR** |
| Orthogonal Trajectories, Newton's law of cooling, Growth & Decay. | | |
| **TUTORIAL NO.08** | **Applications of Ordinary Differential Equations** | **01 HOUR** |
| Electric circuits, Chemical applications- Mixing problems. | | |
| **TUTORIAL NO.09** | **Linear Differential Equations of Higher Order** | **01 HOUR** |
| General solutions of linear differential equations with constant coefficients, Shortcut methods to find P.I. | | |
| **TUTORIAL NO.10** | **Linear Differential Equations of Higher Order** | **01 HOUR** |
| Shortcut methods to find P.I., Method of variation of parameters, Cauchy and Legendre's linear differential equation. | | |

| TUTORIAL NO.11 | Partial Differential Equations | 01 HOUR |
|---|---|---|
| Introduction and formation of partial differential equation, solution of a partial differential equation, equations solvable by direct integration. | | |
| **TUTORIAL NO.12** | **Partial Differential Equations** | **01 HOUR** |
| Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method. | | |
| **TUTORIAL NO.13** | **Guest Lecture** | **02 HOUR** |
| Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method. | | |
| **TUTORIAL NO.14** | **Doubt Clearing Session** | **01 HOUR** |
| Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method. | | |

**TEXT BOOKS**


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.
2. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.


**REFERENCE BOOKS**


1. Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379-8858). Addison-Wesley.
2. Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.
3. Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.
4. O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.
5. Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Engineering Physics |
| | COURSE CODE | 2301102T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**COURSE OBJECTIVES :**

2301102T.CEO.1: Make students identify the basic concept of measurements and to formulate problems in physical and mathematical terms.

2301102T.CEO.2: Analyze the behavior of light as a wave and get acquaint with different applications in Physics.

2301102T.CEO.3: Classify and understand the difference of classical mechanics and quantum mechanics.

2301102T.CEO.4: Derive the basic laws governing the motion of quantum particles.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301102T.CO.1: Make use of the basics of measurement aspects to obtain acceptable solutions under given conditions [L3].

2301102T.CO.2: Infer theoretical principles of optical phenomenon observed in daily life experience [L4].

2301102T.CO.3: Apply the knowledge of quantum mechanics to study the behavior of quantum particles [L3].

2301102T.CO.4: Analyze the necessity of quantum mechanics in context of failure of classical mechanics [L4].

## COURSE ABSTRACT

Since 'technology' has been generally understood as the application of 'science' to find answers to questions confronting us in a wide spectrum of inquiry, so a profound understanding of science is necessary to facilitate building sound intellectual capacity in the area of technology. Various areas of engineering studies are found to be applying concepts discussed in Physics as for instance measurement, optics, quantum-mechanics to name a few which have been instrumental/ pivotal in the development of Engineering branches like Robotics, Mechanical Engineering, Computer Science, Chemical Engineering, Civil Engineering and Electronics and Telecommunications; besides other specific allied areas as Artificial Intelligence, Big-Data Analysis and Quantum Computing. The course of Engineering Physics discusses the basics and analyses the understanding of topics like measurement of physical variables, wave-phenomenon, basics of Quantum Mechanics and its applications thereof. Most of the contents of this course act as a mandatory in terms of extrapolating its further extension to address the basics of Quantum Computing and other such emerging technologies.

## THEORY COURSE CONTENTS

| UNIT 1 | Measurement of Physical Quantities | 6 HOURS |
|---|---|---|

**Applications/Case Study:** Measuring methods in classical mechanics, measuring methods in quantum mechanics.

**Contents:** Concept of (i)significant numbers, (ii) accuracy versus precision (iii)error versus uncertainty (iv)systematic error versus random error (v) quantifying the uncertainty. Least-count of an apparatus, Methods to measure least-count with specific examples of travelling microscope and spectrometer. importance of estimation and guesstimation in measurement.

**Self Study:** Span (orders of magnitude) of prominent physical parameters. Length-scale and time-scale of specific physical phenomenon, classical-mechanical-measurement versus quantum-mechanical-measurement.

| UNIT 2 | Wave Properties of Light | 8 HOURS |
|---|---|---|

**Applications/Case Study:**Coating of lenses as an application of thin film interference.

**Contents:** Particle nature and wave-nature with examples of wave and particle behavior of light, Introduction to wave nature, Concept of thin film, Stokes law of phase-change on reflection from a thin film, Thin film interference, Interference in films of uniform and non-uniform thickness (with derivation), Newton Ring Experiment, basics of polarization of electromagnetic wave.

**Self Study:** Superposition Principle, Applications of thin-film interference, Diffraction as a particular case of interference, Application of polarized light.

| UNIT 3 | Quantum Mechanics-I | 8 HOURS |
|---|---|---|

**Applications/Case Study:** Plank's quantum law of blackbody radiation

**Contents:** Shortcomings or failure of Classical Mechanics (with specific example of blackbody radiation), Matter-waves, De-Broglie's concept of matter waves, Heisenberg's Uncertainty Principle.

**Self Study:** Blackbody radiation.

| UNIT 4 | Quantum Mechanics-II | 8 HOURS |
|---|---|---|

**Applications/Case Study:** Application of electron in a potential well in case of Bohr's atomic model.
**Contents:** Wave-function, Physical significance of wave function, Schrodinger's equations, Time Dependent and Time Independent forms of Schrodinger Equations, Applications of Schrodinger Equation, Electron in an infinite potential well (rigid box).
**Self Study:** Electron in a finite deep potential well (non-rigid box).
**Further Study:** Concept of quantum mechanical tunneling

## TEXT BOOKS


1. Feynman R.P., Leighton R.B., Sands M. (2013). The Feynman Lectures on Physics: (Vols.1-3) Narosa Publishing House.
2. Ghatak A. (2016). Optics (6th edition). TMH.


## REFERENCE BOOKS


1. Morris A.S. (2001). Measurement and Instrumentation Principles (3rd edition). Butterworth Heinemann.
2. Jenkins & White (2016). Fundamentals of Optics (4th edition). Mc Graw Hill Science.
3. Beiser A., Mahajan S., Choudhary S.R. (2009) Concepts of Modern Physics (6th edition). Mc Graw Hill Education (India) Pvt. Ltd.
4. Schiff L.I., Bandhyopadhyay J. (2017) Quantum Mechanics (4th edition). MH Education (India) Pvt. Ltd.
5. Dirac P.A.M. (2004) Principles of Quantum Mechanics (4th edition). CBS publishers and Distributors 2004.
6. Griffiths D.J. (2016) Introduction to Quantum Mechanics (2nd edition). Cambridge India.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Engineering Physics Lab |
| | COURSE CODE | 2301102L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**COURSE OBJECTIVES :**

2301102L.CEO.1: To acquire hands-on experience in setting up and using fundamental physics apparatus.

2301102L.CEO.2: To cultivate students' ability to conduct experiments, analyze data, and draw meaningful conclusions.

2301102L.CEO.3: Encourage students to identify sources of experimental error, and propose improvements.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301102L.CO.1: Demonstrate proficiency in using basic laboratory equipment relevant to physics experiments [L2].

2301102L.CO.2: Interpret the experimental data obtained from measurement of physical variables [L2].

2301102L.CO.3: Develop improved experimental-skills evidenced by their ability to identify sources of errors and propose appropriate precautions [L3].

## COURSE ABSTRACT

Since 'technology' has been generally understood as the application of 'science' to find answers to questions confronting us in a wide spectrum of inquiry, so a profound understanding of science is necessary to facilitate building sound intellectual capacity in the area of technology. Various areas of engineering studies are found to be applying concepts discussed in Physics as for instance measurement, optics, quantum-mechanics to name a few which have been instrumental/ pivotal in the development of Engineering branches like Robotics, Mechanical Engineering, Computer Science, Chemical Engineering, Civil Engineering and Electronics and Telecommunications; besides other specific allied areas as Artificial Intelligence, Big-Data Analysis and Quantum Computing. The course of Engineering Physics discusses the basics and analyses the understanding of topics like measurement of physical variables, wave-phenomenon, basics of Quantum Mechanics and its applications thereof. Most of the contents of this course act as a mandatory in terms of extrapolating its further extension to address the basics of Quantum Computing and other such emerging technologies.

**PRACTICALS**: Seven (7) number of experiments among those listed below to be conducted. Maximum two experiments may be substituted (by faculty in consultation with students) with Experimental hands-on activity/ies among those listed below.

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Interpretation of given data** | **2 HOURS** |
| Analysis of a given data set in terms of implied uncertainties and tolerance to evaluate validity of a result. (Note: The given data may be in terms of graph as well). | | |
| **PRACTICAL NO.02** | **Estimation and guesstimation** | **2 HOURS** |
| To predict the expected outcome of a given experimental problem under scientific reasoning justifying the experimental conditions. | | |
| **PRACTICAL NO.03** | **Signiftcant Figures** | **2 HOURS** |
| Determination of the mass of electron (me) upto specified significant numbers. | | |
| **PRACTICAL NO.04** | **Interference of Light Waves** | **2 HOURS** |
| Calculate the refractive index of a given liquid using Newton Rings' Experiment. | | |
| **PRACTICAL NO.05** | **Diffraction of Light Waves** | **2 HOURS** |
| Determination of the line density of a diffraction grating using Laser. | | |
| **PRACTICAL NO.06** | **Interference of Light Waves** | **2 HOURS** |
| Calculate the wavelength of Sodium light source using Michelson Interferometer. | | |
| **PRACTICAL NO.07** | **Phase and Phase-Difference** | **2 HOURS** |
| Determination of the phase-difference between two given positions on the path of simple pendulum in periodic motion. | | |
| **PRACTICAL NO.08** | **Polarization** | **2 HOURS** |
| Determination of the specific rotation of a sugar solution of a given concentration. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.9** | **Division of Amplitude of Light Waves** | **2 HOURS** |
| Determination of Radius of Curvature of a given planoconvex lens using Newton's Rings apparatus. | | |
| **PRACTICAL NO.10** | **Diffraction as a Particular Case of Interference** | **2 HOURS** |
| Calculation of wavelength of different colors using a white light. | | |
| **PRACTICAL NO.11** | **Malus' Law** | **2 HOURS** |
| Verification of Malus' law under experimental conditions. | | |
| **PRACTICAL NO.12** | **Brewster's Law** | **2 HOURS** |
| Determination of refractive index of given unknown material. | | |
| **Hands-on Activity No.1** | **Wave/ Quantum mechanics: Effect of measurement on the state of an observable** | **4 HOURS** |
| Measuring the change in state of an observable using Malus' law under experimental conditions. | | |
| **Hands-on Activity No.2** | **Signiftcant digits in experimental result** | **2 HOURS** |
| Number of significant digits in the obtained result as a function of different methods used to determine a physical variable/ observable. | | |

**TEXT BOOKS**


1. Worsnop B.L., Flint H.T. (2002). Advanced practical Physics for students. Methuen & Co. Ltd. https://archive.org/details/in.ernet.dli.2015.86393/page/n7/mode/2up.
2. Ghatak A. (2021). The ten most beautiful experiments in science. (1st edition). Viva Books.


**REFERENCE BOOKS**


1. Worsnop B.L., Flint H.T. (2002). Advanced practical Physics for students. Methuen & Co. Ltd. https://archive.org/details/in.ernet.dli.2015.86393/page/n7/mode/2up.
2. Ghatak A. (2021). The ten most beautiful experiments in science. (1st edition). Viva Books.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING** | **W.E.F** | **AY:** - 2024 (Rev. (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Electrical & Electronics Engineering |
| | **COURSE CODE** | 2307101T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307101T.CEO.1: To impart knowledge of single-phase and three-phase AC circuits.
2307101T.CEO.2: To get acquainted with different electrical machines.
2307101T.CEO.3: To familiarize with blocks of DC power supply and BJT operation.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2307101T.CO.1: Illustrate Single Phase and three phase Systems [L2].
2307101T.CO.2: Identify electrical machines used in typical domestic and industrial Application [L3].
2307101T.CO.3: Construct analog circuits using suitable components [L3].

**COURSE ABSTRACT:**

This course focuses on developing important technical concepts in a comprehensible, coherent and rigorous way. This comprehensive course provides students with a solid foundation in the principles, theories and practical applications of Electrical and Electronics Engineering. Students will delve into the fundamental concepts of electrical circuits, power analysis, semiconductor devices and digital electronics. Students will also explore the intricate world of semiconductor devices including diodes, transistors, power supply design and uncover their applications in electronic circuits.

**THEORY COURSE CONTENT**

| | | |
|---|---|---|
| **UNIT 1** | **Single Phase Electrical Systems** | **6 HOURS** |

**Contents:** Introduction to basic Electrical elements, AC fundamentals, Series and Parallel AC circuits, Power ratings of home appliances (fan, tube light, mixer etc), Study of Electrical connection of house, Fuse, MCBs and grounding for safety at home.

**Activity:** Energy Consumption calculation for your Home

**Self Study:** 1.To study Ohms Law, KCL-KVL 2.Use of Basic Electrical Elements in house

| | | |
|---|---|---|
| **UNIT 2** | **Three Phase Electrical Systems** | **5 HOURS** |

**Contents:** Introduction to Three Phase systems, Delta and Star connections, Relation between line and phase quantities (with Phasor Diagrams), Power in three phase circuits for Star and Delta connections, Introduction to Indian Power system

**Activity:** Overview of Indian Power Scenario- Flipped Classroom

**Self Study:** Selections of Star and Delta Connections as per load requirements

| | | |
|---|---|---|
| **UNIT 3** | **Electrical Machines** | **06 HOURS** |

**Contents:** Single Phase Transformers: Construction, Types, Working Principle, EMF equation, Efficiency

DC Motor: Construction, Working principle, Types of DC Motors, Torque-speed characteristics

**Activity:** Study of Motors used in Various applications-Mind map

**Self Study:** Basics of PMDC, BLDC, Stepper motor, Single Phase AC Motors

| | | |
|---|---|---|
| **UNIT 4** | **Analog Electronics and Power Supply Design** | **06 HOURS** |

**Contents:** Diode, Clipper circuits, Rectifier circuits, DC Regulated power supply, BJT: Construction, Configurations, DC Load Line, Q-point, Switch and Amplifier

**Activity:** Build and Simulate standard circuit using any Mobile application

**Self Study:** Study of Clamper Circuit

| UNIT 5 | Digital Systems | 7 HOURS |
|---|---|---|

**Contents:** Number systems, Logic gates, SOP, K-Map, Combinational circuits: Adder, Subtractor, Mux, Code converter, Sequential circuit: Flip-Flops, Register

**Activity:** K-Map Puzzle

**Self Study:**

1- Programmable Logic Devices (PLDs)

2- Digital Circuit Simulators

## TEXT BOOKS


1. Edward Hughes (2011) *"Electrical and Electronic Technology"* , 10th edition, Pearson India, ISBN-13: 978-8131733660
2. Thomas L. Floyd (2018) *"Electronics Devices"*, 10th edition, Pearson Education India, ISBN-13: 978-1292222998
3. A. Anand Kumar (2016) *"Fundamentals of Digital Circuits"*, 4th edition, Prentice Hall of India, ISBN-13: 978-8120352681


## REFERENCE BOOKS


1. V. N. Mittle and Arvind Mittal (2005). *"Basic Electrical Engineering"*, 2nd edition, McGraw Hill Education, ISBN-13: 978-0070593572
2. D. P. Kothari,I.J.Nagrath (2010). *"Electric Machines"*, 4th edition, McGraw Hill. ISBN: 978-0070699670.
3. Paul Horowitz, Winfield Hill *"The Art of Electronics"*, 3rd edition,Cambridge University press, ISBN: 978-0521809269

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING** | **W.E.F** | **AY:** - 2024 (Rev.(NEP) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Electrical & Electronics Engineering Lab |
| | **COURSE CODE** | 2307101L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307101T.CEO.1: To relate truth tables and logic expressions for various digital application.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2307101T.CO.1: Build simple digital logic applications [L3].

**COURSE ABSTRACT:**

The course Electrical and Electronics Engineering combines theory with hands on laboratory experiments where students will have the opportunity to construct and test electronics circuits and work with real world electrical devices.

| **PRACTICALS** | | |
|---|---|---|
| **SESSION NO.1** | **Overview in First Session** | **2 HOURS** |
| a. Three phase voltage generation and its waveform<br>b. General structure of Electrical Power System, three phase 4-wire system (introductory approach)<br>c. Safety measures in electrical system, benefits of energy conservation<br>d. Introduction to DMM, Dimmer stat / Variac, CRO/DSO, Function generator<br>e. Introduction to breadboard and its working | | |
| **PRACTICAL NO.1** | **R-L-C series A.C. Circuit** | **2 HOURS** |
| a. To calculate exact values of R, L and C for variations in XL and XC (2 cases)<br>b. To justify the lagging and Leading nature for any two cases | | |
| **PRACTICAL NO.2** | **Veriftcation of relation between Line and Phase quantities in Star and Delta circuits** | **4 HOURS** |
| a. To understand Line, Phase quantities and types of connections in Three phase supply<br>b. To connect Bulb load in Star and Delta connection to verify the relation between Line and Phase Quantities<br>**Activity 01: A.C. Circuit Analysis:** To demonstrate concepts like phase, frequency and peak-to-peak voltage on CRO/DSO | | |
| **PRACTICAL NO.3** | **Open circuit and Short circuit test on a Single-Phase transformer** | **2 HOURS** |
| a. To find iron losses and no-load circuit parameters<br>b. To find full load copper losses and Equivalent circuit parameters<br>c. To determine efficiency and regulation of transformers at various different loading conditions<br>**Activity 02: Simple DC Motor Model:**<br>a. Build a basic model of DC Motor using coil of wire, a magnet and a battery<br>b. Make the coil to rotate (Apply concept of Magnetic field and current) | | |

| PRACTICAL NO.4 | DC Regulated Power Supply | 4 HOURS |
|---|---|---|
| a. To design Half and Full Wave Rectifier Circuits by using breadboard<br>b. To understand 12V/ 9V/ 5V IC based DC regulated power supply (Theoretically) with Datasheets<br>c. To test and observe waveforms at various stages on CRO and measure the voltage using DMM | | |
| **PRACTICAL NO.5** | **BJT as a switch and Amplifter** | **4 HOURS** |
| a. BJT as a switch – On/Off the LED at the output by switching BJT<br>b. BJT as an Amplifier – Measure voltages and observe waveforms at input and output of the single stage CE amplifier<br>**Activity 03: Diode Application:** Design Rectifier Circuits (HWR/FWR) on breadboard | | |
| **PRACTICAL NO.6** | **Logic Gates** | **4 HOURS** |
| To study and verify truth tables of Logic Gates (AND/OR/NAND/NOR) | | |
| **PRACTICAL NO.7** | **Combinational Circuits** | **4 HOURS** |
| a. To design and implement half adder and Full adder<br>b. To design and implement Full Adder by dual 4:1 MUX (IC-74LS153) and verify truth table | | |
| **PRACTICAL NO.8** | **Sequential Circuits (Flip Flops)** | **4 HOURS** |
| To verify Truth table of flip-flops practically using ICs<br>**Activity 04: Boolean Expressions:** Implementation and verification of Boolean Expression on breadboard | | |

## TEXT BOOKS


1. Edward Hughes (2011) *"Electrical and Electronic Technology"* , 10th edition, Pearson India, ISBN-13: 978-8131733660
2. Thomas L. Floyd (2018) *"Electronics Devices"*, 10th edition, Pearson Education India, ISBN-13: 978-1292222998
3. A. Anand Kumar (2016) *"Fundamentals of Digital Circuits"*, 4th edition, Prentice Hall of India, ISBN-13: 978-8120352681


## REFERENCE BOOKS


1. M. Morris Mano, Michael D. Ciletti *"Digital design"*, 4th edition,Pearson, ISBN: 978-0131989245

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: - 2024 (Rev. NEP) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Foundation of Computing |
| | COURSE CODE | 2304101T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** Basics of Computer and Mathematics

**COURSE OBJECTIVES :**

2304101T.CEO.1: Enhance problem solving abilities of students.
2304101T.CEO.2: Develop a logic to efficiently use the programming constructs to solve the computing problems.
2304101T.CEO.3: Encourage the test driven coding approach.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304101T.CO.1: Design a solution to the problem by applying appropriate logic to get the desired results.[L3]
2304101T.CO.2: Design an algorithm and flowchart for the problem using traditional and tool-based approaches.[L3]
2304101T.CO.3: Solve the real world problems by multiple programming solutions.[L3]

**COURSE ABSTRACT:**

The Course emphasizes logic building and problem-solving abilities to write efficient algorithms and understanding how to debug and test C programs. C is the best programming language to start learning in computer programming. The significance of the C programming language is that it is recognized worldwide and used in many of the applications, including advanced scientific systems and operating systems. The C language provides the base language of all advanced computer languages. Course contains basic elements of C programming,data types, operators, Control Structures, conditional statements, looping , arrays, string operations, functions, pointers,user defined data types-structure and union.

**THEORY COURSE CONTENTS**

| UNIT 1 | FUNDAMENTALS OF C | 04 HOURS |
|---|---|---|

**Applications/Case Study:** Introduction to SCRATCH tool, Gaming applications, calculator application

**Contents:** Introduction to programming, why to learn programming, programming for everybody, Overview of C, Character set, Constants, Variables and Keywords, Data types, Operators - arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operator, Expressions- Type Conversion, precedence and order of evaluation

**Self Study:** Using conditions and loops on SCRATCH

| UNIT 2 | CONTROL STRUCTURES | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Ticket Booking App, online shopping site

**Contents:** Decision Control Structure-If statement, if-else statement, Nested if-else statement, Ternary operator, Case Control structure- Switch Case Statements, GOTO statement, Loop Control Structure-while statement, do while statement, for statement, odd loop, nesting of loops, break and continue statement, finite and infinite Loop

**Self Study:**Prepare Algorithm and Flowchart for the control statements above

| UNIT 3 | ARRAYS, STRINGS, FUNCTIONS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Leader Board of a game, Spell Checkers,Search Engine

**Contents:** Array Declaration and Initialization, Bounds Checking, Array arithmetic, One dimensional arrays and multi-dimensional Arrays, Strings - Standard Library String Functions, Array of strings, String operations, Functions, procedures, Difference between functions and procedures, Function definition and prototype, Scope Rule of Functions, Calling Conventions, Passing Values between Functions - Call by Values, Recursive functions, Passing Array Elements to a Function

**Self Study:** How to pass 2D array as a function parameter, Variable Length Arrays (VLAs) in C

| UNIT 4 | POINTERS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Dynamic Memory Allocation, Implementation of Data Structures

**Contents:** Pointers and Addresses, Pointer Notation and Arithmetic, Pointer to an array, Array of pointers, Pointer to a function, Passing pointers as function arguments, function call by reference, difference between call by value and call by reference, Strings and Pointers, Structures and Pointers

**Self Study:** Pointer to Pointer (Double Pointer), Chain of Pointers in C

| UNIT 5 | USER DEFINED DATA TYPES | 04 HOURS |
|---|---|---|

**Applications/Case Study:** Memory management, Database Management

**Contents:** Structures and Union: Declaration of Structure and Union, Difference between Structure and Union, Accessing Structure Elements, How Structure Elements are Stored, Array of Structures

**Self Study:** Anonymous Union and Structure in C, Enumeration (enum) in C

**Further Readings:** User Defined Data Type- class in CPP

## TEXT BOOKS


1. E. Balguruswamy , "Computing Fundamentals and C Programming" , Tata Mc-Graw Hill, ISBN 13: 978-0-07-066909-3
2. Balagurusamy, E. (2016). Programming In Ansi C.
3. Kanetkar, Y. (2018). Let us C. BPB publications.
4. Yashavant, K. (2020). Let us C. BPB Publications.
5. Kernighan, B. W., & Ritchie, D. M. (2002). The C programming language.
6. GHOSH, S. (2008). All of C. PHI Learning Pvt. Ltd.


## REFERENCE BOOKS


1. Hanly, J. R., & Koffman, E. B. (2007). Problem solving and program design in C. Pearson Education India.
2. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, Oxford University Press, ISBN 13 978-0-19-806528-9
3. S. Thamrai Selvi, R Murugesan, "Test your skills in C", Tata Mcgraw Hill, ISBN13:978-0-07- 044759-2
4. Yashvant Kanitkar, "C Projects", BPB Publication, 2nd Edition, ISBN 81-7029-256-5
5. R.G. Dromey , "How to solve it by Computer", Prentice Hall, ISBN -13. 978-0134340012
6. Byron S. Gottfried, Jitender Kumar Chhabra, "Programming with C", Tata Mcgraw Hill, ISBN13:978-0- 07-059369-5


## E-R ESOURCES

1. https://nptel.ac.in/courses/106105171
2. https://www.geeksforgeeks.org/c-programming-language/
3. https://www.w3schools.com/c/
4. https://www.codechef.com/ide
5. https://scratch.mit.edu/
6. https://www.youtube.com/@bhagyashreealhat4824/videos

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: - 2024 (Rev. NEP) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Foundations of Computing Lab |
| | COURSE CODE | 2304101L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 02 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Basics of Computer and Mathematics

**COURSE OBJECTIVES :**

2304101L.CEO.1: Facilitate the building of programming solutions using the appropriate programming constructs.

2304101L.CEO.2: Encourage logical thinking to find alternate programming solution for the given problem.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304101L.CO.1: Make use of appropriate programming constructs to solve real world problems. [L3]

2304101L.CO.2: Build modular, reusable code using functions, recursions and standard library functions. [L3]

2304101L.CO.3: Build a programming solution with suitable logic to get the required output.[L3]

**COURSE ABSTRACT:**

The Foundation of Computing Lab is a hands-on course designed to complement the theoretical knowledge of C programming with practical experience. This lab course aims to develop a deep understanding of the C language through a series of lab assignments, home assignments and real-world problem-solving scenarios. Students will learn the fundamentals of programming in C, including data types, control structures, functions, arrays, pointers.Emphasis is placed on writing optimized, readable, and error-free code via test driven approach.

**PRACTICALS**

| **PRACTICAL NO.01** | **Fundamentals of C** | **4 HOURS** |
|---|---|---|

**Practice Problem Statements:**

1. * Write a menu driven program in C to display addition, subtraction, multiplication, division of two numbers
2. Write a program in C to display the quotient and remainder after the division of two numbers
3. Write a program to evaluate any mathematical expression and observe the operator precedence
4. Write a program in C to demonstrate the use of left shift, right shift, and, or, xor operators

**Assignment:**

1. Write a program in C to demonstrate logical and relational operators

| **PRACTICAL NO.02** | **Control Structures** | **6 HOURS** |
|---|---|---|

**Practice Problem Statements:**

1. * Write a program in C to display the grade obtained by the student in a course. The input will be the marks obtained and the output will be the grade obtained
2. * Write a program in C to display first N numbers on the screen using while, do while and for loop
3. * Write a program in C to display first N number in reverse order on the screen using while, do while and for loop
4. * Write a program in C display various patterns using * ( Any two Patterns)
5. Get the information of lengths of sides and angles of triangle and print the type of triangle whether it is equilateral, isosceles or scalene, right, acute or obtuse.

**Assignment:**

1. Prepare a grocery bill after applying 5% discount for new customer and 10% discount for regular customer

| PRACTICAL NO.03 | Arrays, Strings and Functions | 8 HOURS |
|---|---|---|

**Practice Problem Statements:**

1. * Write a program in C to perform matrix addition
2. * Write a program in C to implement linear search and binary search algorithms for a numeric array
3. * Write a program in C to convert every lowercase letter to uppercase letter and vice versa
4. * Write a program in C to implement the string functions using the standard library functions supported by string.h like: string length, string copy, string reverse, string concatenate, string compare, sub string
5. Write a program in C to perform matrix multiplication
6. Take three different arrays to store numbers divisible by 2, 3 and 5 respectively. Get 20 numbers as input and place them in appropriate array
7. Write a C function to find simple interest. Pass input values as parameters
8. Write a program in C using recursion to display the Fibonacci sequence for a given range

**Assignment:**

1. Write a menu driven program in C using functions to implement the following string operations without using the standard library functions, string concatenate, string compare, string palindrome

| PRACTICAL NO.04 | Pointers | 8 HOURS |
|---|---|---|

**Practice Problem Statements:**

1. * Write a program to differentiate between pointer to an integer and pointer to an array of integers
2. * Write a program to print addresses of array elements using pointers
3. * Write a C function to swap values of two variables using call by reference
4. * Write a program to store and access string using pointer to string
5. Print numbers within given range by passing the function pointer as a parameter
6. Demonstrate working of circular linked list using pointers

| PRACTICAL NO.05 | User Deftned Data Types | 2 HOURS |
|---|---|---|

**Practice Problem Statements:**

1. * Write a program in C to accept the information of five students and store it in structure and display the same
2. Write a C program using structure to store employee data (Name and salary) , then display name of the manager who is having highest salary, and obtain total expenditure of company on employee's salary

**Assignment(Any one):**

1. Use structure and pointers to maintain Olympic game's data. Store the information of medals won by several countries. Depending upon the types of medals won by the respective country give the rank
2. Use structure and pointers to maintain books data. Depending upon the number of readers of a book measure the popularity of that book

| PRACTICAL NO.06 | Competitive Coding | 4 HOURS |
|---|---|---|

* Solve scenario based real world problems by developing a solution in series of steps such as designing algorithms, data structures, coding/programming and testing.
Note: Practice Multiple Problems

**TEXT BOOKS**


1. E. Balguruswamy , "Computing Fundamentals and C Programming" , Tata Mc-Graw Hill, ISBN 13: 978-0-07-066909-3
2. Balagurusamy, E. (2016). Programming In Ansi C.
3. Kanetkar, Y. (2018). Let us C. BPB publications.
4. Yashavant, K. (2020). Let us C. BPB Publications.
5. Kernighan, B. W., & Ritchie, D. M. (2002). The C programming language.
6. GHOSH, S. (2008). All of C. PHI Learning Pvt. Ltd.

## REFERENCE BOOKS


1. Hanly, J. R., & Koffman, E. B. (2007). Problem solving and program design in C. Pearson Education India.
2. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, Oxford University Press, ISBN 13 978-0-19-806528-9
3. S. Thamrai Selvi, R Murugesan, "Test your skills in C", Tata Mcgraw Hill, ISBN13:978-0-07- 044759-2
4. Yashvant Kanitkar, "C Projects", BPB Publication, 2nd Edition, ISBN 81-7029-256-5
5. R.G. Dromey , "How to solve it by Computer", Prentice Hall, ISBN -13. 978-0134340012
6. Byron S. Gottfried, Jitender Kumar Chhabra, "Programming with C", Tata Mcgraw Hill, ISBN13:978-0- 07-059369-5


## E-RESOURCES

1. https://nptel.ac.in/courses/106105171
2. https://www.geeksforgeeks.org/c-programming-language/
3. https://www.w3schools.com/c/
4. https://www.codechef.com/ide
5. https://scratch.mit.edu/
6. https://www.youtube.com/@bhagyashreealhat4824/videos

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Linux Fundamentals and Programming |
| | COURSE CODE | 2304161T |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304161T.CEO.1: To create awareness of Open Source Operating Systems.
2304161T.CEO.2: To understand the concepts of Linux and its various distributions.
2304161T.CEO.3: To illustrate the complete use of CLI.
2304161T.CEO.4: To identify the concepts of shell scripting.
2304161T.CEO.5: To understand the use of applications in Linux platform.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304161T.CO.1: Acquire the knowledge on various Linux Distributions and understand the installation processes [L3].
2304161T.CO.2: Classify and compare the Directories and the sub directories of Debian and RPM distributions [L2].
2304161T.CO.3: Demonstrate the GNOME Desktop Environment for easy accessibility [L3].
2304161T.CO.4: Distinguish between various text editors and implement with the help of CLI [L4].
2304161T.CO.5: Explain various commands, arguments and the control operators using CLI [L2].

## COURSE ABSTRACT

This comprehensive course provides students with a fundamentals of Linux operating Systems. Students will also explore the world of open source operating system usage in programming context and uncover their applications in Computer Engineering. The course Linux Fundamentals and Programming combines theory with hands on laboratory experiments where students will have the opportunity to construct programs and scripts and work with real world applications.

## THEORY COURSE CONTENT

| THEORY | COURSE CONTENTS | 15 HOURS |
|---|---|---|

**Introduction:**
History, Linux and Unix, What is Open Source, Licensing, Distributions, Pros and Cons, Common GNU software.

**Directory Structure:**
Common Directories, Directory listing, Application Directory Structure, The File System.

**The GNOME Desktop:**
The Desktop View, The Applications (E-mail, Web Browsers, Chat etc.), The Files and the Directories, Network, Backup.

**The Command Line Interface:**
What is Command Line Interface (CLI)?, The Text Editors, The Manual (MAN) pages.

**Shell Scripting:**
What is Shell, Commands and Arguments, Control Operators, Shell Programming.

**Case Study:**
Study of any application like E-mail System or File Server using any Linux Distribution.

## TEXT BOOKS

1. Machtelt Garrels (2004). *"Introduction To Linux: A Beginner's Guide"*, 2nd edition, Fultus Corp, ISBN-13: 978-0974433936.
2. Daniel J. Barret (2016). *"Linux Pocket Guide: Essential Commands"*, 3rd edition, Wiley Publication, ISBN-13: 978-9352133864.

## REFERENCE BOOKS

1. Christopher Negus (2020). *"Linux Bible"*, 10th edition, Wiley Publication, ISBN-13: 978-1119578888.
2. William Shotts (2019). *"The Linux Command Line: A Complete Introduction"*, 2nd edition,No Stretch Press, ISBN-13: 978-1593279523.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Linux Fundamentals and Programming Lab |
| | COURSE CODE | 2304161L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | 35 | NIL | NIL | NIL | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304161L.CEO.1: To create awareness of Open Source Operating Systems.
2304161L.CEO.2: To understand the concepts of Linux and its various distributions.
2304161L.CEO.3: To illustrate the complete use of CLI.
2304161L.CEO.4: To identify the concepts of shell scripting.
2304161L.CEO.5: To understand the use of applications in the Linux platform.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304161L.CO.1: Describe the various Linux Distributions and the installation processes [L3].
2304161L.CO.2: Classify the Directories and the sub directories [L3].
2304161L.CO.3: Illustrate the GNOME Desktop view [L4].
2304161L.CO.4: Demonstrate and highlight The CLI and various text editors [L5].
2304161L.CO.5: Analyze commands, arguments and the control operators [L5].

## COURSE ABSTRACT

This comprehensive course provides students with a fundamentals of Linux operating Systems. Students will also explore the world of open source operating system usage in programming context and uncover their applications in Computer Engineering. The course Linux Fundamentals and Programming combines theory with hands on laboratory experiments where students will have the opportunity to construct programs and scripts and work with real world applications.

| PRACTICAL ASSIGNMENTS | | |
|---|---|---|
| **PRACTICAL NO.1** | | **2 HOURS** |
| Installation of Linux Operating System and configuration of the system in the network. | | |
| **PRACTICAL NO.2** | | **2 HOURS** |
| Using text editor like Vim, execute basic commands. | | |
| **PRACTICAL NO.3** | | **4 HOURS** |
| Working with the Files and Directories. Execute the commands on the CLI ( Basic Commands). | | |
| **PRACTICAL NO.4** | | **2 HOURS** |
| Working with the File contents using CLI. | | |
| **PRACTICAL NO.5** | | **4 HOURS** |
| The User Management (Passwords, profiles, groups). | | |
| **PRACTICAL NO.6** | | **2 HOURS** |
| File Security (File Permissions, Access Control Lists). | | |
| **PRACTICAL NO.7** | | **2 HOURS** |
| Write a script to print Hello World on terminal using echo command. | | |
| **PRACTICAL NO.8** | | **2 HOURS** |
| Write a script to show usage of if condition. | | |
| **PRACTICAL NO.9** | | **2 HOURS** |
| Write a script to show usage of if else condition. | | |
| **PRACTICAL NO.10** | | **2 HOURS** |
| Write a script to show how to declare an array and access its elements. | | |
| **PRACTICAL NO.11** | | **2 HOURS** |
| Write a simple script to show the usage of command line arguments, Here we access positional arguments using $1, $2. | | |
| **PRACTICAL NO.12** | | **4 HOURS** |
| Install and configure any application like E-mail System, Web Server. | | |

## TEXT BOOKS


1. Machtelt Garrels (2004). *"Introduction To Linux: A Beginner's Guide"*, 2nd edition, Fultus Corp, ISBN-13: 978-0974433936.
2. Daniel J. Barret (2016). *"Linux Pocket Guide: Essential Commands"*, 3rd edition, Wiley Publication, ISBN-13: 978-9352133864.


## REFERENCE BOOKS


1. Christopher Negus (2020). *"Linux Bible"*, 10th edition, Wiley Publication, ISBN-13: 978-1119578888.
2. William Shotts (2019). *"The Linux Command Line: A Complete Introduction"*, 2nd edition,No Stretch Press, ISBN-13: 978-1593279523.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (English) Lab |
| | COURSE CODE | 2301111L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301111L.CEO.1: To explain the sounds in English and introduce phonemic transcription.
2301111L.CEO.2: To illustrate the application of fundamental English grammar.
2301111L.CEO.3: To strengthen listening and reading skills with the use of audio and visual aids.
2301111L.CEO.4: To extend the appropriateness of the writing skills in English.
2301111L.CEO.5: To prepare advanced presentations using Canva.
2301111L.CEO.6: To improve communicative competence in English.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301111L.CO.1: Make use of the sounds of English accurately [L3].
2301111L.CO.2: Apply English grammar rules precisely in practical situations [L3].
2301111L.CO.3: Build vocabulary and listening skills using audio-visual aids [L3].
2301111L.CO.4: Develop syntax and texts in English coherently and formally [L3].
2301111L.CO.5: Utilise Canva to improve presentation skills professionally [L3].
2301111L.CO.6: To enhance communicative competence in English [L3].

## COURSE ABSTRACT

The course ”Communication Skills: English” primarily focuses on developing communication skills through practical application and utilising language abilities. The objective is to achieve this goal by employing efficient communication and maintaining a constructive demeanour. Students are encouraged to use English as a communication skill to understand speech and body language nuances. This is achieved through activity-based methods and approaches in the language laboratories. The training programme facilitates students' persuasive skills development while fostering improved interpersonal relationships through effective verbal communication. The course enhances students' proficiency and accuracy in communicative competence in English. It enables them to effectively communicate in various contexts, such as society, higher education, and the professional workforce. The course also trains students in using proper practical grammar to enhance effective articulation in English, exploring the primary factors and variables contributing to their difficulties in oral proficiency.

## PRACTICALS

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Pronunciation and Phonemic Transcription** | **4 HOURS** |
| Identification of correct pronunciation of words by decoding phonemic scripts; writing phonemic transcriptions of the given words. | | |
| **PRACTICAL NO.02** | **Tense and Common Errors** | **6 HOURS** |
| Use of tenses in day to day communication and academic writing. | | |
| **PRACTICAL NO.03** | **Listening Skills** | **4 HOURS** |
| Active listening; Conversations, audio and video clips; Listening with comprehension. | | |
| **PRACTICAL NO.04** | **Vocabulory Enrichment** | **4 HOURS** |
| Online exercises on AWL and NAWL using web-based applications; Dictionary Skills and Common errors in grammar while speaking and writing English. | | |
| **PRACTICAL NO.05** | **Resume, Cover Letter and Email Writing** | **4 HOURS** |
| How to write an email, characteristics and essentials of a good email, resume, formal letter writing and layout of business letters . | | |
| **PRACTICAL NO.06** | **Essay Writing** | **4 HOURS** |
| What is an essay? Tips to write a good essay, Types of essays. | | |
| **PRACTICAL NO.07** | **Report Writing** | **4 HOURS** |
| Types of reports, format and writing a report, what is summarizing? Rules of summarizing. | | |

| PRACTICAL NO.08 | Presentation Skills-Canva | 6 HOURS |
|---|---|---|
| Essentials of effective presentations; Data collection and compilation; Preparation of outlines. | | |
| **PRACTICAL NO.09** | **Group Discussions** | **4 HOURS** |
| Concept of GD, Criteria for evaluation, types of GD – General, Creative and Technical, Dos and Don'ts, Guidelines for participation and success, Group Dynamics, Expression of thoughts and ideas, body language and interpersonal and analytical skills. | | |
| **PRACTICAL NO.10** | **Role Play** | **4 HOURS** |
| Role-play for verbal communication, team building and group dynamics, decision making, leadership, analytical and creative thinking, group presentation. | | |
| **PRACTICAL NO.11** | **Debate** | **4 HOURS** |
| Concept, Dos and Don'ts, Guidelines for participation and success, Expression of thoughts and ideas, body language and interpersonal and analytical skills. | | |
| **PRACTICAL NO.12** | **Persuasive Speaking** | **6 HOURS** |
| Attributes of a good public speaker; prepared and extemporaneous speech; Listening and Reading to famous speeches. | | |
| **PRACTICAL NO.13** | **Reading Comprehension** | **6 HOURS** |
| Techniques of reading- Intensive, Extensive, Skimming and Scanning; Reading Comprehensions. | | |

**REFERENCE BOOKS**


1. Ashok Thorat and Munira Lokhandwala: Enriching Oral and Written Communication in English, ISBN 9788125037446.
2. Swan, M. (2005). Practical english usage (Vol. 688). Oxford: Oxford university press.
3. Dutt et.al. : A Course in Communication Skills, Foundation, 1 edition.
4. Peter Roach: English Phonetics and Phonology, 4th Edition, Cambridge, ISBN-0521149215.
5. Lynch: Listening, Cambridge, 1st edition, ISBN- 0521707757.
6. Malcom Goodale: Professional Presentations, Cambridge, ISBN- 8175962577.
7. Aggarwal, S. (2009). Essential communication skills. Ane Books Pvt Ltd.
8. Jennings: Communication Basics, Cengage Learning, 1st edition, ISBN- 8131515206.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (German) |
| | COURSE CODE | 2301112T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301112T.CEO.1: To introduce German language and enhance knowledge, communication and intellectual capabilities.
2301112T.CEO.2: To extend the appropriateness of writing and speaking skills.
2301112T.CEO.3: To develop ability to respond to simple questions in the German language.
2301112T.CEO.4: To acquire basic vocabulary about daily topics.
2301112T.CEO.5: To improve communicative competence in German.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301112T.CO.1: Apply the foundational aspects of grammar and memorize vocabulary [L3].
2301112T.CO.2: Develop comprehension of low to medium difficulty text and practice speaking about every day basic topics [L3].
2301112T.CO.3: Build the basic communication and comprehension skills for conducting day to day business effectively [L3].
2301112T.CO.4: Make use of simple, familiar expressions to interact with native speakers [L3].
2301112T.CO.5: Develop communicative competence in German language [L3].

## COURSE ABSTRACT

The German course not only gives students an excellent grounding in the language, but also opens up fascinating chances to learn more about German culture, history, and literature. Students develop the foundational skills and more advanced strategies necessary to function in a German -speaking culture. A broad variety of linguistic skills, from being able to express oneself properly in writing and speech to being able to understand different forms and talk convincingly in front of an audience of any size, may be honed by learning the language from the bottom up. You may start from scratch with a new language or build on what you already know in this course. Formal education consists of classroom instruction like lectures, seminars, and tutorials. Additionally, students study German through the lens of linked subjects in the fields of history, language, culture, and religion. This German language course is intended for individuals with a high level of linguistic proficiency who want to either deepen their knowledge of the language or begin learning it from scratch.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction and History** | **2 HOURS** |
| **Contents:**Information about Germany, German History, Culture and Language.<br>**Self Study:** Historical perspectives of German language . | | |
| **UNIT 2** | **Greetings and Introduction** | **4 HOURS** |
| **Contents:** Related Vocabulary Alphabets, Numbers, Countries, Languages, Email-Adress, Phone number, Grammar: W-Questions, Simple Sentences, Verb conjugation and personal pronouns like (I, You, He/She/It, We etc.).<br>**Self Study:** Word Formation. | | |
| **UNIT 3** | **Speaking about hobbys, Making an Appointment, Proftle in Inter-net** | **4 HOURS** |
| **Contents:** Numbers (continued), Activity verbs, regular and irregular verbs, Weekdays, Months, Seasons, Professions, Grammar: articles (der, die, das, die) and yes-no-questions.<br>**Self Study:** Oral conversation. | | |
| **UNIT 4** | **City and Sightseeing** | **6 HOURS** |
| **Contents:**Talking about places in a city (railway station, market, bus stop, mall, theatre, cinema hall, museums etc.), Transport (train, bus, plane, tram, metro), Asking for an address or directions, Comprehension: reading city map and events calendar, Grammar: articles in negation (kein, keine, kein, keine), Imperative sentences with you.<br>**Self Study:** Regional information in Germany. | | |
| **UNIT 5** | **Food** | **4 HOURS** |
| **Contents:**Fruits, Vegetables, Drinks, Meals, shops, Grocery shopping, Grammar: Accusative case.<br>**Self Study:** Cultural Food in Germany. | | |

| UNIT 6 | Time | 6 HOURS |
|---|---|---|
| **Applications/Case Study:**German Translation.<br>**Contents:**Talking about time, asking for time, Making an appointment (part 2), Daily routine, Telephone and email conversations, Grammar: Modalverbs, posessive articles (my, your. . . ).<br>**Self Study:** Time keeping formats. | | |
| **UNIT 7** | **Revision** | **4 HOURS** |
| **Applications/Case Study:** German Translation.<br>**Contents:** Reading and comprehension, Writing, Listening (optional), Speaking. | | |

**TEXT BOOKS**

1. Netzwerk Deutsch als Fremdsprache- Kursbuch A1( Stefanie Dengler), Goyal Publications.

**REFERENCE BOOKS**

1. https://www.klett-sprachen.de , https://www.duolingo.com/

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (Japanese) |
| | COURSE CODE | 2301113T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301113T.CEO.1: To introduce Japanese as a foreign language and enhance knowledge, communication and intellectual capabilities which helps to improve cognitive skills and creativity vital for problem solving and innovation.

2301113T.CEO.2: To develop an awareness of Japanese culture along with providing better career opportunities later in life.

2301113T.CEO.3: To develop ability to respond to simple questions in the Japanese language.

2301113T.CEO.4: To acquire basic vocabulary about daily topics in Japanese language.

2301113T.CEO.5: To develop skills related to reading simple sentences and understanding uncomplicated dialogues.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301113T.CO.1: Develop communication and comprehension skills for conducting day-to-day business effectively

2301113T.CO.2: Understand typical every day and job-related expressions and sentences in the written format.

2301113T.CO.3: Use simple, familiar expressions and produce main ideas of familiar topics when interacting with native speakers or when visiting Japan.

2301113T.CO.4: Develop basic terminology regarding everyday themes in Japanese.

2301113T.CO.5: Hone abilities in reading easy-to-follow words and comprehending straightforward conversations.

## COURSE ABSTRACT

Learning Japanese gives students a firm grasps of the language as well as a window into Japanese society, history, and literature. Students acquire both the basic and advanced skills necessary to function effectively in a Japanese-speaking culture. Starting from scratch with a language is the best way to develop fluency in all aspects of communication, from reading and writing to speaking in front of large groups with ease. The course is designed to help students learn a new language and improve their existing skills. To acquire knowledge, students participate in classroom activities such as lectures, seminars, and tutorials. In addition, they study Japan and its culture from a variety of angles, including its history, language, culture, and religion. This course is intended with a high level of linguistic proficiency who wants to either expand their knowledge of Japanese or begin learning it from scratch.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction** | **3 HOURS** |
| **Contents:** Information about Japan, Japanese History, Culture and Language.<br>**Self Study:** Japanese Background . | | |
| **UNIT 2** | **Greetings, Self Introduction, Japanese Script** | **6 HOURS** |
| **Contents:**Self-Introduction- Jikoshoukai, Greeting Words, Hiragana Series, Simple vocabulary in Hiragana.<br>**Self Study:**Introduce yourself. | | |
| **UNIT 3** | **Understanding Japanese Script** | **4 HOURS** |
| **Contents:** Katakana Series, Simple vocabulary in Katakana, Introduction of the concept of time .<br>**Self Study:** Japanese script. | | |
| **UNIT 4** | **Understanding Simple Sentence Patterns, Time, Prices, Adjectives** | **5 HOURS** |
| **Contents:** Basic sentence pattern, Use of demonstrative pronouns, Numbers, Expressing time, Asking for / telling prices, Adjectives.<br>**Self Study:** Grammatical Components. | | |
| **UNIT 5** | **Date, Verbs, Directions, Binding Sentences** | **6 HOURS** |
| **Contents:** Dates, time, frequencies, Verbs in the present and past tense, Coming/Going to, Binding and building longer sentences.<br>**Self Study:** Binding sentences. | | |
| **UNIT 6** | **Amounts of Time/Money, Distance, Describing Existence, Counters** | **6 HOURS** |
| **Applications/Case Study:**German Translation.<br>**Contents:**Asking/Telling the amount of time and money, Going from/to, Describing the existence/non-existence of something, Counters.<br>**Self Study:** Describing existence. | | |

**REFERENCE BOOKS**


1. Introduction to Nihongo- Haru 1- Maharashtra State Bureau of Textbook Production and Curriculum Research.
2. Minna No Nihongo-1-1 Japan Foundation.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (French) |
| | COURSE CODE | 2301114T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301114T.CEO.1: To introduce French language and enhance knowledge, communication and intellectual capabilities.
2301114T.CEO.2: To extend the appropriateness of writing and speaking skills.
2301114T.CEO.3: To develop ability to respond to simple questions in the French language.
2301114T.CEO.4: To acquire basic vocabulary about daily topics
2301114T.CEO.5: To improve communicative competence in French.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301114T.CO.1: Apply the foundational aspects of grammar and memorize vocabulary [L3].
2301114T.CO.2: Develop comprehension of low to medium difficulty text and practice speaking about every day basic topics [L3].
2301114T.CO.3: Build the basic communication and comprehension skills for conducting day-to-day business effectively [L3].
2301114T.CO.4: Make use of simple, familiar expressions to interact with native speakers [L3].
2301114T.CO.5: Develop communicative competence in French language [L3].

## COURSE ABSTRACT

The French course provides students with a solid foundation in the language and opportunities to delve further into a foreign culture, history, and literature. Students learn the fundamentals and advanced techniques they need to succeed in a society where French language is spoken. Learning the language from the ground up helps hone a wide range of linguistic abilities, from expressing yourself clearly in speaking and writing to comprehending various formats to confidently address an audience of any size. The course provides with the option to learn a language from the ground up or to expand on any prior knowledge of the language. Students learn through formal training, lectures, seminars, and tutorials. In addition, they pursue a curriculum in French studies through related themes in historical, linguistic, cultural, religious, and other settings. The French course is designed for students with advanced language abilities to deepen their mastery of a foreign language or begin studying it from scratch.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction** | **5 HOURS** |
| **Contents:** Vous connaissez la France ? - Introduction.<br>**Self Study:** Spoken task -record an audio. | | |
| **UNIT 2** | **Presentation and Questioning** | **5 HOURS** |
| **Contents:** Autour de moi- Presenting and questioning Nouns.<br>**Self Study:** Written task- forming questions and exercises. | | |
| **UNIT 3** | **Syntax** | **5 HOURS** |
| **Contents:** Le monde- Sentence structure, talking about oneself, countries, cities ,etc.<br>**Self Study:** Written task- form sentences about oneself, countries, cities ,etc. | | |
| **UNIT 4** | **Speaking and Writing Skills** | **5 HOURS** |
| **Contents:**Ma famille- writing and talking about :Family, house and time.<br>**Self Study:** Written task- form sentences about one's family and house. | | |
| **UNIT 5** | **Writing Task** | **5 HOURS** |
| **Contents:** Mes loisirs- writing and talking about :Hobbies.<br>**Self Study:** Written task- form sentences using different verbs and talk about one's hobbies. | | |
| **UNIT 6** | **Spoken and Written Daily Routine** | **5 HOURS** |
| **Contents:** Ma routine- writing and talking about : daily activities, seasons and one's body.<br>**Self Study:** Written task- form sentences about one's daily routine and seasons. | | |

## TEXT BOOKS

1. Saison 1(unit 1-6)- Didier.

## REFERENCE BOOKS

1. Extracts from: Alter Ego 1, En Echanges, Entre jeunes, Apprenons le francais.
2. Worksheets.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Liberal Learning |
| | COURSE CODE | 2301182 |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**COURSE OBJECTIVES :**

2301182.CEO.1: Create a comprehensive understanding of diverse forms of expression that contribute to liberal education

2301182.CEO.2: Create a broad set of skills and perspectives for overall development and personal well being.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301182.CO.1: Develop proficiency in expressive arts, amateur interest for holistic development as a lifelong learning [L6].

2301182.CO.2: Teach personal and social well-being through mind-body practices for the cultivation of free human beings [L3].

## COURSE ABSTRACT

Liberal education is a learning approach that teaches students how to think independently and develop broad academic and intellectual abilities. It rests on a multidisciplinary and interdisciplinary approach. Education Policy, which had a revamp in 2020 has laid out a path for universities to adopt a liberal education, discussion based and discovery base mode of education. It encourages a multidisciplinary education system that helps develop the creative and analytical sides of the brain simultaneously. It inculcates transferable skill set, ability to apply knowledge to practical real-world situations, connecting the dots through various mental models, habits of self-reflection, contextual learning, freedom of the mind and lifelong learning. India needs a liberal education because to enhance Interdisciplinary and multidisciplinary approach to learning and Preparing students to become real-world person.

**THEORY COURSE CONTENTS: Students may select any one of the following tracks.**

| | | |
|---|---|---|
| **Track 1** | **Chess** | **30 HOURS** |

Introduction to game of Chess. Rules, movement of pieces, strengths and weaknesses of all pieces. Stalemate, touch move, etiquette, pawn promotion and zugzwang, square of the pawn. Fundamental checkmate patterns, basic rules, special moves and rules such as castling, promotion, EnPassant, good moves for the opening.

| | | |
|---|---|---|
| **Track 2** | **Kabaddi** | **30 HOURS** |

Recent trends in kabaddi - History and Development. a) Different forms played - Zemini, Sanjeevani & Amar. b) Different chants (cant) - Hadu-Du, Chedu-Gudu, Hu-tutu & other forms. c) Played in different size playfields with different number of players. d) No uniform rules and regulations, Traditional Kabaddi, Modern Kabaddi. Kabaddi Pioneers: Raiders, Escaping tactics by raiders in different situation, Before starting of the raid strategies, during the raid strategy and tactics, Turning, Falling and sliding as tactics, Creating gap to escape .

| | | |
|---|---|---|
| **Track 3** | **Drama** | **30 HOURS** |

Introduction to Acting, Introduction to Theatre Techniques and Design Theatre History, Literature and Aesthetics, basics of Acting, Theatre Techniques and Design, and Theatre History, Literature and Aesthetics. In the second semester the same subjects are studied in details. Specialisation in Acting, Theatre Techniques and Design Theatre History, Literature and Aesthetic. Theatre History, Literature and Aesthetics, Acting (specialisation).

| | | |
|---|---|---|
| **Track 4** | **Singing** | **30 HOURS** |

Vocal cords, Voice types, Female: Soprano or alto, Male: Tenor, baritone or bass, Breathing Techniques, Role of breathing in singing, types of scales and pitches, Musical notes foundation of any song, Humming exercise, tongue twisters, vowels, Tempo of song, Tempo Markings, Practicing all octaves, analysis of songs, practicing songs.

| Track 5 | Dance | 30 HOURS |
|---|---|---|
| History, mythological aspects, and their impact on the dance form, movements, pattern of beats, use of these forms, Basic knowledge of: basic Adavu steps, hand gestures 'Mudra', Nritta, nrittya and Natakas, Tala, Gati, postures, moods, feet movements, and stances. Introduction to Bollywood dance, Basic Bollywood combinations/choreography, Introduction of styles of Bollywood, Introduction of dance choreographies from classic and modern Bollywood films, influence and inclusion of western dance. History of street dance steps and styles and the pioneers and dance legends involved in their creation, Basic steps of Hip Hop dance, Learn foundations & routines within hip hop culture, Types of hip hop: contemporary hip hop, lyrical hip hop, etc. Dance history, Learning about warm ups, floor work, standing work, travelling work, articulation of limbs, turns and jumps etc. | | |
| **Track 6** | **Painting (Design)** | **30 HOURS** |
| Object Drawing / Still Life - Graphic sketching, mutual proportion of object groups, space joiner, shadow differentiation on objects, Sketching and painting of object groups Memory Drawing - observation, memory and imagination, proportional sketching of incidents in daily life, closeness and distantness (perspective) in drawing. Design – creative expression, basic principles of design, effective use of colors and color shades, aesthetic sense and creation of utility through design, geometrical equipment and material, color mediums and techniques. Geometry, Solid Geometry and Lettering - Development of capability of use of geometrical constructions for creation of pattern, geometrical shapes and their construction. | | |
| **Track 7** | **Sculpture Design** | **30 HOURS** |
| The fundamental principles and techniques of sculpture, including the exploration of various materials and processes, sculptural skills and conceptual thinking. Introduction to sculpture, Brief history of sculpture, tools handling and techniques, material handling techniques, methods & applications – additive & subtractive, pinching method & slab method (application), concepts Development - perceive line as an edge, understanding fundamental elements & principles of sculpture tools handling and techniques, concept understanding. | | |
| **Track 8** | **Introduction to photography** | **30 HOURS** |
| Types of Lights, effect of Lights, Types of Lenses & their uses. Understanding the three main ingredients or elements or pillars of photography that work together: Aperture, Shutter Speed, and ISO. Understanding the concept of ISO sensitivity, in detail with hands-on session. Understanding the concept of Shutter Speed, effect of high & low shutter speed on photographs, with hands-on session. Concept of aperture, F-stop notations, effect of variation of aperture on images. Hands-on session. Compositional Rules like Rule of Thirds, Negative Space, Horizon Line, Golden ratio etc. Framing. Hands-on training. Difference between Auto focus & manual focus, Focusing the object manually, concept of depth of field with wide aperture lens. Hands-on. Framing in landscape photography, bird photography framing. Bokhe effect, Time lapse, multiple exposure, Silhouettes, Long exposure, Steel wool photography. | | |

| Track 9 | Yoga and Meditation | 30 HOURS |
|---|---|---|
| Brief history and philosophy of Yoga, benefits of Yoga, Key techniques of Yoga. Introduction to different types of Yoga, understanding the diversity of yoga practices and their origins, Yoga-Sutras, Limbs of Yoga. Introduction to Meditation, understanding the essence and benefits of meditation, introduction to different types and approaches to meditation, Meditation techniques for health promotion, Relaxation techniques. Overview of Postural alignment, importance of postures, Practices of various posture. Understanding the importance of a balanced diet for overall well-being, Principles of balanced nutrition, diet for preventive and curative aspects of health, Mind Power. Gentle warm-up and stretching, Introduction to seated forward bends and gentle backbends, Relaxation techniques: Guided progressive muscle relaxation. Introduction to breathing and its significance, understanding the role of breathing in overall well-being, importance of conscious breathing in stress reduction and relaxation. Yogic breathings techniques. Intended to various Asana, benefits of Asana. Introduction to pranayama, pranayama techniques for health promotion practical sessions, difference between pranayama and deep breathing, Anuloma-viloma, Suryabhedana, Ujjayi, Bharmari, Bhastrika, Shitali and Shitkari Pranayama. Understanding of Mudras and Kriyas, Practical sessions . | | |
| **Track 10** | **Spiritual Minds** | **30 HOURS** |
| 1.Spirituality -True meaning of Spirituality and explaining the hierarchy of Inner world, awareness about Existence of God.2.Yoga & Meditation- Explaining the Chakras and the Aura, various types of Mediations.3.Respect, Gratitude & Reverence -Explaining the meaning Respect, Gratitude & Reverence by giving the examples from Mahabharata and try to cultivate these qualities in the students.4.Low of Forgiveness and Low of KARMA-Explaining the deepest meaning of Law of forgiveness and Law of KARMA and make the student refrain from unwholesome actions and behaviors.5.Relationship- how to maintain and improve the relationship with Parents, friends, people around us and NATURE.6.Physical and Mental Health – how to improve Physical and Mental health with the help of circadian rhythm, mediation, Pranayamas and yogasanas. How to become more productive.7.Stress Management- discuss the root cause of stress, types of Stress. Explain the techniques and remedies to overcome the Stress.8.Love Yourself – How to give quality time to 'yourself', how to make yourself anxiety free and find the real happiness within us.9.Let's Label jars and not people- how to refrain from to criticism and judgmental with the people around us.10.Goal setting- how to set goals in your life and how to achieve those goals in a positive manner. | | |
| **Track 11** | **Content Writing** | **30 HOURS** |
| Introduction to Content Writing, Writing Fundamentals, Research skills, Blog Writing, Website Writing, Role of SEO in Content Writing, Content Marketing Strategy, Portfolio Development & Career Opportunities, Branding (in copywriting point of view), Technical writing, UX/UI writing, AI in content writing (ChatGPT). | | |

| Track 12 | Digital Marketing | 30 HOURS |
|---|---|---|
| Basics digital marketing, analysis and keyword research, search engine optimization, on-page optimization, off-page optimization, SEO updates and analysis, local business and google mapping, google adwords or pay per click marketing (SEM), social media optimization, social media marketing, google web analytics, webmaster tools, creating a new simple website. Illustrating the dialog delivery, expressions, volume, pitch in the dialog, Expression through photography and editing skill with an expertise in handling cameras, microphone, effective management skill enabling the justification through foundation till representation. | | |
| **Track 13** | **Social Work** | **30 HOURS** |
| Importance of Empathy, Empathy and it's limits, Role of empathy and compassion for engineers, Empathy activities, Differences, Conservatives and Liberals, Disgust and Honor, Stereotypes, The Problem of Kindness, Skepticism About the Self, Free Will and the Situation, Recognizing emotions, reading body language, improving listening skills, mindful self-compassion, Compassionate Leadership, Origins of Morality, joy of giving, social responsibility, exercising social services. | | |
| **Track 14** | **Indian Food Wisdom** | **30 HOURS** |
| History - Introduction, Food consumed in different regions of India, Eating styles of India, Traditional equipment's used for cooking, changes in consumption of foods, Future of traditional foods, Advantages, types, health benefits of Indian food, Millets – Importance of millets in diet, millet as a medicine etc. | | |

**NOTE :** More tracks can be added as per demand of the students and feasibility.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** - 2024 (Rev. (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Indian Knowledge Systems: Vedic Mathematics |
| | **COURSE CODE** | 2304181T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 25 | NIL | 50 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304181.CEO.1: To facilitate the students with the concepts of Indian traditional knowledge
2304181.CEO.2: To make them understand the Importance of roots of knowledge system.
2304181.CEO.3: To encourage students to think creatively and critically about mathematical concepts
2304181.CEO.4: To bring forward the extraordinary work done by Indian Mathematicians in the fields such as Astronomy, Astrology, Geometry, Algebra, and Arithmetic etc.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304181.CO.1: Explain the historicity and broad classification of Indian knowledge System [L2].
2304181.CO.2: Demonstrate key Vedic Mathematics principles by understanding foundational concepts and providing clear insights into the underlying principles and relationships [L2].
2304181.CO.3: Apply Vedic mathematics methods to solve a variety of mathematical problems, showcasing proficiency in applying these techniques to diverse scenarios [L3].
2304181.CO.4: Analyze and evaluate the efficiency and suitability of different Vedic mathematics approaches in solving specific types of problems demonstrated through a detailed project or case study presentation [L3].

**COURSE ABSTRACT:**

Course outlines the importance of Indian Knowledge System and its contributions to diverse fields.This course will help learners to know and understand their own systems and traditions which are imperative for any real development and progress. Because of this course learners will think independently and originally with Indian frameworks and models for solving the problems of present day. Vedic Mathematics will not have direct application in Computer Engineering as a specialized field, however it offers benefits and insights that are relevant in certain context. It will be used in logic development, Problem Solving, data analysis and designing of algorithms. Recognizing methodologies to simplify calculation is one of the skill in Vedic Mathematics. This skill can be valuable in dealing with complex real life applications.Deeper concepts helpful in Programming context, problem solving skills can be considered as outcomes of Vedic Mathematics in Computer Engineering discipline.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Indian Knowledge System – An Introduction** | **04 HOURS** |

**Applications/Case Study:** Connections between different fields of study and an affection for traditional knowledge

**Contents:** Introduction and need of IKS; historic importance of IKS; Why do we need IKS; Organization of IKS; Historicity of IKS; Some salient aspects of IKS

**Further Readings/Self Study:** Linkage of Mathematics and IKS

| | | |
|---|---|---|
| **UNIT 2** | **Introduction to Indian Mathematics** | **02 HOURS** |

**Applications/Case Study:** Mathematical Innovations in $17^{th}$ and $18^{th}$ Century

**Contents:** Introduction to Indian Mathematics; Unique aspects of Indian Mathematics; Indian Mathematicians and their Contributions

**Further Readings/Self Study:** Impact of Mathematical Innovations on society

| | | |
|---|---|---|
| **UNIT 3** | **Deep Insights in to Indian Mathematics** | **12 HOURS** |

**Applications/Case Study:** Basic Sutras and subsutras in Vedic Mathematics

**Contents:** Arithmetic; Algebra; Geometry; Trigonometry; Binary mathematics and combinational problems in Chandaḥ Śāstra; Magic squares in India

**Further Readings/Self Study:** application of Chandaḥ Śāstra in designing of algorithms

| | | |
|---|---|---|
| **UNIT 4** | **Astronomy** | **04 HOURS** |

**Applications/Case Study:** Linear measures of celestial coordinate system.

**Contents:** Unique Aspects of Indian Astronomy, Historical Development, The Celestial Coordinate System, Elements of the Indian Calendar.

**Further Readings/Self Study:** Positional Astronomy.

| ACTIVITY(a) | Activity Based on IKS (25 Marks) | 01 HOUR |
|---|---|---|
| Activity based on the IKS will assess student's knowledge and comprehension of the course content. The purpose of the activity is to evaluate the participants' understanding and knowledge of IKS. | | |
| **ACTIVITY(b)** | **Field Visit and Report Writing (25 Marks)** | **08 HOURS** |

Students are required to conduct a field visit to the local places mentioned below.Upon completion of the field visit, students must write a report on the visit, its analysis,and submit the detail report for assessment

**Field Visit Guideline :**

**Archaeological Sites:** Visit archaeological sites like ancient temples and caves (Karla, Bhaja Bedse Caves, old temples) Vedic mathematics emphasizes geometric principles and formulas. These principles may have been applied in the design and construction of ancient temples and caves. These architecture often involves intricate geometric patterns and proportions, which could have been influenced by Vedic mathematical concepts.

**Museums:** Explore museums that exhibit ancient artifacts, tools, and techniques. (Raja Dinkar Kelkar Museum, Mahatma Phule Museum, Deccan College Museum, Darshan Museum) Observe any mathematical symbols, notations, or representations found in ancient artifacts. These can provide clues about how mathematical concepts were recorded and communicated in ancient times.

**Historical Monuments:** Visit historical sites featuring iconic artifacts. (Aga Khan Palace, Shaniwar Wada, Sinhgad Fort) Recognize the interdisciplinary nature of Vedic mathematics by understanding its connections to architecture, astronomy, and religious practices. Explore how mathematics played a role in these diverse fields. Appreciate the importance of preserving and conserving archaeological sites that offer insights into Vedic mathematics and ancient knowledge systems.

**Educational Institutions:** Visit universities or research institutes with metallurgy depart- ments. These institutions often have laboratories and facilities that demonstrate cutting-edge research in Mathematics e.g. Savitribai Phule Pune University, Indian Institute of Science Education and Research (IISER), College Technological University, Pune (COEP) Recognize how the mathematical achieve- ments of ancient India, including Vedic mathematics, continue to inspire modern mathematicians and educators.

| ACTIVITY(c) | Multimodal Activities (25 Marks) | 04 HOURS |
|---|---|---|

Students are required to perform any one activity as assessment and submit: The activity evaluates students understanding and application of Vedic Mathematics principles. It includes a range of mathematical problems and calculations based on Vedic techniques. Assessment criteria may encompass accuracy, speed, and proficiency in employing Vedic Math methods to problems.

**Poster Presentation:** Students are required to create a visually appealing and informative poster that summarizes a specific topic or concept related to the course. The poster should effectively convey key points, including information, visuals. Assessment criteria may include content clarity, visual design, organization, and the ability to articulate ideas during the presentation.

**Video Documentary:** Students are tasked with producing a short video documentary that explores a particular aspect of the course. This assessment component encourages students to research, script, film, and edit a video that presents their chosen topic in a compelling and informative manner. Evaluation criteria may include content accuracy, storytelling, production quality, and overall impact.

**Model Making:** In this task, students are asked to create a physical model or representation of a concept or object relevant to the course. The model should demonstrate a deep understanding of the subject matter and may include annotations or explanations to clarify its significance. Assessment criteria could include accuracy, creativity, craftsmanship, and the ability to explain the model's relevance.

**Product Making:** This component challenges students to design and produce a practical product or prototype related to the course content. Students design and craft practical products or prototypes inspired by Indian Knowledge System principles. This hands-on activity fosters creativity and practical application of IKS Students may need to consider materials, functionality, and how their product addresses a real-world problem or application. Evaluation might focus

## TEXT BOOKS


1. Mahadevan B., Pavana N., Bhat Vinayak R.,(2022). *Introduction to Indian Knowledge System: Concepts and Applications*. 1st Edition, PHI Learning. ISBN 978-9391818203.

2. Patil Chaitanya A.,(2018). *Learn Vedic Speed Mathematics Systematically and Step by Step*. 1st Edition, Chaitanya A. Patil Publication. ISBN 9789353008406.


## REFERENCE BOOKS


1. Bose, D. M. Sen, S.N. Subbarayappa,B. V. (2010). A Concise History of Science in India. 2nd Edition, Universities Press Publisher, Hyderabad. ISBN 9788173716195.
2. Boyer Carl B., (2011). A History of Mathematics. 3rd Edition. Wiley Publication. ISBN 9780470630563

3. Cooke Roger L. (2011). The History of Mathematics: A Brief Course. 2ND Edition. Wiley Publication. ISBN 9781118030240

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Statistics and Integral Calculus |
| | COURSE CODE | 2301103T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301103T.CEO.1: To extend the basic concepts of integration for evaluation of complex integration problems.
2301103T.CEO.2: To categorize and use equation of curves to trace the given curve.
2301103T.CEO.3: To demonstrate an understanding towards evaluating multiple integrals.
2301103T.CEO.4: To relate and examine the applications of multiple integrals.
2301103T.CEO.5: To study different statistical methods for solving problems.
2301103T.CEO.6: To analyse different probability distribution functions.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301103T.CO.1: Evaluate complex integrals [L3].
2301103T.CO.2: Sketch curves by analysing the given equation of curves [L3].
2301103T.CO.3: Evaluate the multiple integrals [L3].
2301103T.CO.4: Apply the knowledge of multiple integrals to solve engineering problems [L3].
2301103T.CO.5: Assess statistical problems [L4].
2301103T.CO.6: Solve the probability distribution problems [L3].

## COURSE ABSTRACT

This course includes some of the main ideas on integral calculus, a wide domain of mathematics that has many applications relevant to the future engineer. Also included different methods of computing integrals and applications of multiple integrals as area, volume, centre of gravity and moment of inertia using different types of examples.Main objective of this course is to identify different methods to evaluate integrals, to demonstrate an understanding towards evaluating multiple integrals, to relate and examine the applications of multiple integrals, to analyze different probability distribution functions, to study different statistical methods for solving problems.It explains the concepts of probability theory and statistics which are needed for handling various real- world problems.As a part of the studies we emphasize more on real life applications of the topics and based on that different activities are also conducting in timely manner. By doing this we inculcate the curiosity of the students towards research.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Integral Calculus** | **08 HOURS** |
| **Contents:** Reduction formulae, Gamma function, Beta function, Differentiation under integral sign.<br>**Self Study:** DUIS rule 2 | | |
| **UNIT 2** | **Curve Tracing and Rectiftcation** | **07 HOURS** |
| **Applications/Case Study:** Rose Curves<br>**Contents:** Tracing of Curves: Cartesian curves, Parametric curves, Polar curves. Rectification: Rectification of Cartesian, Parametric and Polar curves .<br>**Self Study:** Parametric Curves . | | |
| **UNIT 3** | **Multiple Integrals** | **07 HOURS** |
| **Contents:** Double integration, Evaluation of Double integration, Change of order of Integration, Integration by transforming Cartesian to polar coordinate systems, Triple Integration, Integration by transforming to spherical and cylindrical polar coordinates.<br>**Self Study:** Coordinate system. | | |
| **UNIT 4** | **Applications of Multiple Integrals** | **07 HOURS** |
| **Contents:** Applications of multiple integrals to find Area, Volume, Centre of Gravity, and<br>**Self Study:** Moment of Inertia. | | |
| **UNIT 5** | **Statistics** | **08 HOURS** |
| **Applications/Case Study:** Corona Graph.<br>**Contents:** Measures of central tendency, standard deviation, coefficient of variation, moments, skewness and kurtosis, correlation(Karl Pearson's coefficient of correlation) and regression .<br>**Self Study:** Measures of Central Tendency,Standard Deviation,Coefficient of Variation | | |
| **UNIT 6** | **Probability** | **08 HOURS** |
| **Contents:** Probability, probability density function, probability distribution: Binomial, Poisson, Normal.<br>**Self Study:** Bayes' Theorem. | | |

## TEXT BOOKS


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.


## REFERENCE BOOKS


1. Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379-8858). Addison-Wesley.
2. Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.
3. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.
4. Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.
5. O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.
6. Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.
7. Montgomery, D. C., & Runger, G. C. (2010). Applied statistics and probability for engineers. John wiley & sons.
8. Johnson, R. A., Miller, I., & Freund, J. E. (2000). Probability and statistics for engineers (Vol. 2000, p. 642p). London: Pearson Education.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Statistics and Integral Calculus Tutorial |
| | COURSE CODE | 2301103U |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 1 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301103U.CEO.1: To extend the basic concepts of integration for evaluation of complex integration problems.
2301103U.CEO.2: To categorize and use equation of curves to trace the given curve.
2301103U.CEO.3: To demonstrate an understanding towards evaluating multiple integrals.
2301103U.CEO.4: To relate and examine the applications of multiple integrals.
2301103U.CEO.5: To study different statistical methods for solving problems.
2301103U.CEO.6: To analyse different probability distribution functions.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301103U.CO.1: Evaluate complex integrals [L3].
2301103U.CO.2: Sketch curves by analysing the given equation of curves [L3].
2301103U.CO.3: Evaluate the multiple integrals [L3].
2301103U.CO.4: Apply the knowledge of multiple integrals to solve engineering problems [L3].
2301103U.CO.5: Assess statistical problems [L4].
2301103U.CO.6: Solve the probability distribution problems [L3].

## COURSE ABSTRACT

This course includes some of the main ideas on integral calculus, a wide domain of mathematics that has many applications relevant to the future engineer. Also included different methods of computing integrals and applications of multiple integrals as area, volume, centre of gravity and moment of inertia using different types of examples.Main objective of this course is to identify different methods to evaluate integrals, to demonstrate an understanding towards evaluating multiple integrals, to relate and examine the applications of multiple integrals, to analyze different probability distribution functions, to study different statistical methods for solving problems.It explains the concepts of probability theory and statistics which are needed for handling various real- world problems.As a part of the studies we emphasize more on real life applications of the topics and based on that different activities are also conducting in timely manner. By doing this we inculcate the curiosity of the students towards research.

| **TUTORIALS** | | |
|---|---|---|
| **TUTORIAL NO.01** | **Integral Calculus** | **01 HOUR** |
| Reduction formulae, Gamma function. | | |
| **TUTORIAL NO.02** | **Integral Calculus** | **01 HOUR** |
| Beta function, DUIS Rule1 & 2. | | |
| **TUTORIAL NO.03** | **Curve Tracing** | **01 HOUR** |
| Tracing of Cartesian, Polar and Parametric curves. | | |
| **TUTORIAL NO.04** | **Rectiftcation** | **01 HOUR** |
| Rectification of Cartesian, Polar and Parametric curves. | | |
| **TUTORIAL NO.05** | **Double Integration** | **01 HOUR** |
| Double Integration, Evaluation of Double Integration, Change the order of integration, Integration by transforming Cartesian to Polar Coordinate system. | | |
| **TUTORIAL NO.06** | **Triple Integration** | **01 HOUR** |
| Triple integration, Integration by transforming to spherical and cylindrical polar coordinates. Application Of multiple integrals: To find Area, Volume. | | |
| **TUTORIAL NO.07** | **Applications of Multiple Integrals** | **01 HOUR** |
| Applications of multiple integrals: To find Centre of Gravity of an arc, plane lamina and a solid. | | |
| **TUTORIAL NO.08** | **Applications of Multiple Integrals** | **01 HOUR** |
| Applications of multiple integrals: To find Moment of Inertia about an arc, plane and solid. | | |
| **TUTORIAL NO.09** | **Statistics** | **01 HOUR** |
| Measures of central tendency, standard deviation, coefficient of variation. | | |
| **TUTORIAL NO.10** | **Statistics** | **01 HOUR** |
| Moments, skewness and kurtosis, Correlation and regression. | | |

| | | |
|---|---|---|
| **TUTORIAL NO.11** | **Probability** | **01 HOUR** |
| Probability, probability density function. | | |
| **TUTORIAL NO.12** | **Probability** | **01 HOUR** |
| , Probability distribution: Binomial, Poisson, Normal. | | |
| **TUTORIAL NO.13** | **Guest Lecture** | **02 HOUR** |
| Applications of statistics in real life. | | |
| **TUTORIAL NO.14** | **Doubt Clearing Session** | **01 HOUR** |
| Unit 1 - Unit 6. | | |

**TEXT BOOKS**


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.


**REFERENCE BOOKS**


1. Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379-8858). Addison-Wesley.
2. Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.
3. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.
4. Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.
5. O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.
6. Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.
7. Montgomery, D. C., & Runger, G. C. (2010). Applied statistics and probability for engineers. John wiley & sons.
8. Johnson, R. A., Miller, I., & Freund, J. E. (2000). Probability and statistics for engineers (Vol. 2000, p. 642p). London: Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF CHEMICAL ENGINEERING | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Science of Nature |
| | COURSE CODE | 2301104T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2301104T.CEO.1: Make students conversant with basic Biology regarding the life processes.

2301104T.CEO.2: Study biology and engineering as biologically inspired technologies like designs in nature, bioenergetics, bioprocesses, biomaterials, biomechanics, and bioinstrumentation.

2301104T.CEO.3: To define the role of chemistry for engineers via atomic structure and green chemistry principles.

2301104T.CEO.4: To define the basic aspects and applications of polymers, biomaterials & composites.

2301104T.CEO.5: To illustrate the basic principles, instrumentation & applications of analytical techniques.

2301104T.CEO.6: To outline the technology involved in improving quality of water for its industrial use.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301104T.CO.1: Illustrate natural biological processes and their technical aspects that changed human life by applying engineering principles [L2].

2301104T.CO.2: Explain the impact of chemical bonding on engineering materials and properties [L2].

2301104T.CO.3: Demonstrate proficiency in applying green chemistry principles to engineering solutions [L2].

2301104T.CO.4: Make use of advanced instrumental methods for the analysis of chemical compounds [L3].

2301104T.CO.5: Analyze information from case studies and applications to strategize solutions for complex real-world engineering challenges [L4].

**COURSE ABSTRACT**

The fundamental objective of the Science of Nature course is to provide the extended knowledge of chemistry & biology required for engineering courses. The course defines the role of chemistry for engineers via topics like atomic structure & green chemistry principles. A few topics like Formation of Materials which covers chemical bonding and their influence on chemical properties & Engineering materials are included. This enables students to understand the application of chemistry in electronic gadgets, in construction, chemical compounds as a conducting materials, as smart materials, as nano materials viz carbon nano materials etc. Further, the analysis part involves various instrumental methods. It is aimed to give information about the advanced characterization and separation techniques of chemical compounds. The biology part of the course includes phenomena observed in nature viz., Physical, Chemical and Biological along with the case studies and applications. This gives much needed information about natural biological processes and their technical aspects in view of optimizing Engineering solutions. This promotes the applicability of engineering in understanding of chemistry/biology and visa-versa.

**THEORY COURSE CONTENTS**

| **UNIT 1** | **Introduction to Science of Nature** | **8 HOURS** |
|---|---|---|

**Contents:** The basics of science of nature. Exploring science in nature, specially symmetry, spiral, golden ratio, pattern and fractal. The phenomenon observed in nature viz., Physical, Chemical and Biological. Case studies and Applications. The diversity and commonality of cells, protein structure and function, basic molecular genetic mechanisms, bio membranes and cell architecture, transport of ions and small molecules across Cell membranes, cellular energetics, cell birth, lineage and death.
**Self Study:** Physiological activities.

| **UNIT 2** | **Applications of Biology** | **7 HOURS** |
|---|---|---|

Physiologic Systems - An Outline of Cardiovascular Structure and Function, Endocrine System, Nervous System, Vision System, Defense mechanisms in plants and animals. Introduction to Bio Sensors, Performance Factors, Factors Affecting the Performance of Sensors, Areas of Application. Biological Sensing Elements, Biological transducers. Discovery and Innovations in applications of Biology. **Self Study:** Locomotion.

| UNIT 3 | The Role of Chemistry for Engineers | 8 HOURS |
|---|---|---|

**Applications/Case Study:** Hydrogen Spectrum.

(A) **Introduction:** This section is an introduction to chemistry and chemical methods for engineering students. It describes how chemistry is used in engineering and how chemical principles aid engineers in the choice of materials for a particular application. Principles of Green chemistry are reviewed. The classification of separation methods used for mixtures. (B) **Periodic Table:** This section covers the names and symbols of the elements. The basic structure of the atom is reviewed including an explanation of isotopes. A discussion of the atomic structure describes electronic shells, subshells, their quantum numbers, orbital shapes, electron filling order, and the determination of the complete electron configuration of the elements. General description of the modern periodic table. Correlation between the valence electron configurations and the chemical properties of the elements. The periodic trends according to the position of the elements in the periodic table.

**Self Study:** Slater's rule for ion.

| UNIT 4 | Chemical Bonding - The Formation of Materials | 9 HOURS |
|---|---|---|

(A) **The Formation of Materials:** This section covers chemical bonding and its effect on the chemical properties of the elements. Ionic bonding & covalent bonding are compared in terms of the octet rule and valence bond theory. Polar and non-polar covalent bonds. Molecular orbital theory is introduced to explain magnetism, bond order and hybridization helpful in Carbon chemistry. Intermolecular forces, including hydrogen bonding, are discussed with a special Case Study focusing on the special properties of water.

(B) **Engineering Materials:** This section covers the Resources of Natural Materials, Introduction to Material Sciences viz. Polymers, Specialty polymers, Biomaterials, Nano materials and Smart materials with their examples and applications.

**Self Study:** Real life applications of smart materials.

| UNIT 5 | Chemical Analysis and Instrumentation | 7 HOURS |
|---|---|---|

This chapter covers some of the more common instrumental methods used for the qualitative and quantitative analysis of materials. The principles of chromatography are introduced with paper chromatography and later applied to thin layer chromatography, pH-metry and Conductometry are reviewed as a few important and basic methods for analysis of chemical compounds and a case study on the analysis of water samples is given as an example. UV-visible absorption spectroscopy is reviewed as one of the sophisticated analytical techniques.

**Self Study:** Applications in Bio-medical field.

| UNIT 6 | Water Treatment and Effluent Management | 6 HOURS |
|---|---|---|

**Applications/Case Study:** Water analysis of river Indrayani.

This chapter covers types of impurities in water & the conventional water treatment methods. Hardness, Alkalinity and Chloride content of water, its causes, types and volumetric methods for their determinations are reviewed along with numerical. Various water softening & treatment methods which includes filtration methods by Carbon adsorption, ion-exchange methods and membrane techniques are explained.

## TEXT BOOKS


1. Jain, P. C., & Jain, M. (1998). Engineering Chemistry: Chemistry of Engineering Materials. Dhanpat Rai Pub. Com.
2. Khopkar, S. M. (2008). Basic of Concept of Analytical Chemistry; 3 rd Edn; New AGF International Pvt. Ltd. Publisher, New Delhi, 1-5.
3. Chauhan, B. S. (2008). Engineering Chemistry. Laxmi Publications, Ltd..
4. Lodish, H., Berk, A., Kaiser, C. A., Kaiser, C., Krieger, M., Scott, M. P., ... & Matsudaira, P. (2008). Molecular cell biology. Macmillan.


## REFERENCE BOOKS


1. Gaffney, J., & Marley, N. (2017). General chemistry for engineers. Elsevier.
2. Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2013). Fundamentals of analytical chemistry. Cengage learning.
3. Willard, H. H., Merritt Jr, L. L., Dean, J. A., & Settle Jr, F. A. (1988). Instrumental methods of analysis.
4. Pradeep, T. (2012). Textbook of nanoscience and nanotechnology. McGraw-Hill Education.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF CHEMICAL ENGINEERING | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Science of Nature Lab |
| | COURSE CODE | 2301104L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2301104L.CEO.1: Make students conversant with basic Biology regarding the life processes.

2301104L.CEO.2: Study biology and engineering as biologically inspired technologies like designs in nature, bioenergetics, bioprocesses, biomaterials, biomechanics, and bioinstrumentation.

2301104L.CEO.3: To define the role of chemistry for engineers via atomic structure and green chemistry principles.

2301104L.CEO.4: To define the basic aspects and applications of polymers, biomaterials & composites.

2301104L.CEO.5: To illustrate the basic principles, instrumentation & applications of analytical techniques.

2301104L.CEO.6: To outline the technology involved in improving quality of water for its industrial use.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301104L.CO.1: Illustrate natural biological processes and their technical aspects that changed human life by applying engineering principles [L2].

2301104L.CO.2: Explain the impact of chemical bonding on engineering materials and properties [L2].

2301104L.CO.3: Demonstrate proficiency in applying green chemistry principles to engineering solutions [L2].

2301104L.CO.4: Make use of advanced instrumental methods for the analysis of chemical compounds [L3].

2301104L.CO.5: Analyze information from case studies and applications to strategize solutions for complex real-world engineering challenges [L4].

## COURSE ABSTRACT

The fundamental objective of the Science of Nature course is to provide the extended knowledge of chemistry & biology required for engineering courses. The course defines the role of chemistry for engineers via topics like atomic structure & green chemistry principles. A few topics like Formation of Materials which covers chemical bonding and their influence on chemical properties & Engineering materials are included. This enables students to understand the application of chemistry in electronic gadgets, in construction, chemical compounds as a conducting materials, as smart materials, as nano materials viz carbon nano materials etc. Further, the analysis part involves various instrumental methods. It is aimed to give information about the advanced characterization and separation techniques of chemical compounds. The biology part of the course includes phenomena observed in nature viz., Physical, Chemical and Biological along with the case studies and applications. This gives much needed information about natural biological processes and their technical aspects in view of optimizing Engineering solutions. This promotes the applicability of engineering in understanding of chemistry/biology and visa-versa.

| | | |
|---|---|---|
| **PRACTICALS:** Any 8 Experiments will be conducted. | | |
| **PRACTICAL NO.01** | **Distillation** | **2 HOURS** |
| Separation of two miscible liquids using distillation process. | | |
| **PRACTICAL NO.02** | **Polymerization** | **2 HOURS** |
| Synthesis by condensation polymerization reaction. | | |
| **PRACTICAL NO.03** | **Nano Particle** | **4 HOURS** |
| Synthesis of nano particles using reduction method. | | |
| **PRACTICAL NO.04** | **pH Metry** | **4 HOURS** |
| Determination of the dissociation constant of a weak acid using pH meter. | | |
| **PRACTICAL NO.05** | **Paper Chromatography** | **2 HOURS** |
| Separation of inorganic cations by paper chromatography. | | |
| **PRACTICAL NO.06** | **TLC** | **2 HOURS** |
| Separation of organic compounds by TLC. | | |
| **PRACTICAL NO.07** | **Conductometry** | **4 HOURS** |
| Conductometric titration for mixture of acids. | | |
| **PRACTICAL NO.08** | **Colorimetry / Spectrophotometry** | **2 HOURS** |
| Absorption studies. | | |
| **PRACTICAL NO.09** | **Hardness of Water** | **4 HOURS** |
| Determination of Hardness of water by EDTA method. | | |
| **PRACTICAL NO.10** | **Alkalinity** | **2 HOURS** |
| Determination of alkalinity of water by neutralization titration. | | |
| **PRACTICAL NO.11** | **Adsorption Studies** | **2 HOURS** |
| Water purification by activated charcoal. | | |
| **PRACTICAL NO.12** | **Physical Phenomenon** | **2 HOURS** |
| Case Studies of Physical Phenomenon | | |
| **PRACTICAL NO.13** | **Chemical Phenomenon** | **2 HOURS** |
| Case Studies of Chemical Phenomenon | | |
| **PRACTICAL NO.14** | **Biological Phenomenon** | **2 HOURS** |
| Case Studies of Biological Phenomenon | | |

## TEXT BOOKS


1. Jain, P. C., & Jain, M. (1998). Engineering Chemistry: Chemistry of Engineering Materials. Dhanpat Rai Pub. Com.
2. Khopkar, S. M. (2008). Basic of Concept of Analytical Chemistry; 3 rd Edn; New AGF International Pvt. Ltd. Publisher, New Delhi, 1-5.
3. Chauhan, B. S. (2008). Engineering Chemistry. Laxmi Publications, Ltd..
4. Lodish, H., Berk, A., Kaiser, C. A., Kaiser, C., Krieger, M., Scott, M. P., ... & Matsudaira, P. (2008). Molecular cell biology. Macmillan.


## REFERENCE BOOKS


1. Gaffney, J., & Marley, N. (2017). General chemistry for engineers. Elsevier.
2. Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2013). Fundamentals of analytical chemistry. Cengage learning.
3. Willard, H. H., Merritt Jr, L. L., Dean, J. A., & Settle Jr, F. A. (1988). Instrumental methods of analysis.
4. Pradeep, T. (2012). Textbook of nanoscience and nanotechnology. McGraw-Hill Education.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: - 2024 (Rev. (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Essentials of Data Science |
| | COURSE CODE | 2304102T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PRE-REQUISITE :**

**COURSE OBJECTIVES :**

2304102T.CEO.1: To get familiar with the basics of Python programming.
2304102T.CEO.2: To learn different data structures in Data Science.
2304102T.CEO.3: To use data computation methods in Data Science.
2304102T.CEO.4: To introduce data manipulation methods in Data Science.
2304102T.CEO.5: To use data visualization methods in Data Science.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304102T.CO.1: Build a python program for handling syntax and semantics for any given problem[L3].
2304102T.CO.2: Demonstrate proficiency in handling data structures useful in Data Science[L3].
2304102T.CO.3: Apply the suitable methods of data computations on real time data[L3].
2304102T.CO.4: Interpret the different methods of data manipulation on real time data[L3].
2304102T.CO.5: Apply data visualization for real time data to get better insights[L3].

## COURSE ABSTRACT

Essentials of Data Science (EDS) is the First Year Semester-II course. This course aims at equipping learners to be able to provide the essence of Data Science by using python programming. In this course, firstly, the learners will learn python fundamentals required for Data Science. The learners are able to use different data organizational structures to store the real time data. Data computations are required to maintain the quality of data. EDS helps to learn different data computations. Data manipulations help in handling missing and noisy values in Data Processing. The learner will learn data storing, loading, cleaning, preparation, wrangling, transformation etc. Data visualization is the practice of translating information into a visual context, such as a map or graph which tends to identify the patterns, trends from the data. This course will increase the learner's interest in Data Science. The activity based learning is adapted to learn this course.

## THEORY COURSE CONTENT

| UNIT 1 | Python Fundamentals for Data Science | 6 HOURS |
|---|---|---|

**App/System/Case study:**Weather Analysis

**Contents:**Introduction, Data Types- Mutable and immutable types, Data Conditioning using Decision Statements and Iterative Statements.

Functions: Basics of functions, variable scope and lifetime, Lambda or anonymous function.

Modules: Introduction to modules, packages and standard library modules.

Data Handling using Files.

**Self Study:**CSV Reader and Writer

**Further Reading:**Excel Reader and Writer

| UNIT 2 | Data Organizational Structures | 6 HOURS |
|---|---|---|

**App/System/Case study:**Retail-Industry/Twitter Reviews

**Contents:**Categories of Data- Unstructured, Structured, Categorical and Time Series

List- Creating List, List operations

Tuple- List of Tuples, Immutability,

Dictionaries- Creating Dictionary, Adding to Dictionary with SetDefault, Loading JSON to Dictionary

Set- Removing Data from Sequences, Performing common data set operation

**Self Study:**JSON File Handling

**Further Reading:**XML File Handling

| UNIT 3 | Data Computation | 6 HOURS |
|---|---|---|

**App/System/Case study:**Stock Market

**Contents:**Data Operations- Arithmetic and Statistical, Bitwise Operators, Linear Algebra, Copying and viewing data in arrays, Stacking, Data Sorting, Data Searching and Indexing, Data counting, Mathematical Operations, Broadcasting, Matrix Operations, Structured Data.

**Self Study:**Fancy Indexing

**Further Reading:**Parallel Processing using Arrays

| UNIT 4 | Data Manipulation | 6 HOURS |
|---|---|---|

**App/System/Case study:**Salary Analysis

**Contents:**Data Loading, Data Storage, Summarizing and Computing Descriptive Statistics, Data Cleaning, Data Preparation, And Data Wrangling: Join, Combine, and Reshape, Data Transformation, Data Aggregation and Group Operations.

**Self Study:**Working on XML and JSON

**Further Reading:**Data Profiling

| UNIT 5 | Data Distribution and Visualization | 6 HOURS |
|---|---|---|

**App/System/Case study:**Sales

**Contents:**Population and Samples

Data Distribution- Statistical Analysis of Data, Data Analytics Techniques; Descriptive, Predictive and Prescriptive, Normal Distribution Significance of Data Visualization in Data Science, Plots- Line Chart, Bar Plot, Histogram, Scatter Plot, Pie Chart, Density Plot, Facet Grids for categorical data, Group Plots

**Self Study:** 3D Visualizations

**Further Reading:**Supervised Learning - Classification-KNN, Regression-Simple Linear Regression

## TEXT BOOK


1. VanderPlas, J. (2016). Python data science handbook: Essential tools for working with data. " O'Reilly Media, Inc.".
2. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".
3. McKinney, W. (2017). Python for data analysis, " O'Reilly Media, Inc".
4. Brownley, C. W. (2016). Foundations for Analytics with Python: From Non-Programmer to Hacker. " O'Reilly Media, Inc.".


## REFERENCE BOOK


1. Mueller, J. P., & Massaron, L. (2019). Python for data science for dummies. John Wiley & Sons.
2. Grus, J. (2019). Data science from scratch: first principles with python. O'Reilly Media.
3. Kane, F. (2017). Hands-on data science and python machine learning. Packt Publishing Ltd.
4. Madhavan, S. (2015). Mastering python for data science. Packt Publishing Ltd.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: - 2024 (Rev. NEP) |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Essentials of Data Science Lab |
| | COURSE CODE | 2304102L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE :**

**COURSE OBJECTIVES :**

2304102L.CEO.1: To get familiar with the basics of Python programming.
2304102L.CEO.2: To learn different data structures in Data Science.
2304102L.CEO.3: To use data computation methods in Data Science.
2304102L.CEO.4: To introduce data manipulation methods in Data Science.
2304102L.CEO.5: To use data visualization methods in Data Science.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304102L.CO.1: Build a python program for handling syntax and semantics for any given problem[L3].
2304102L.CO.2: Demonstrate proficiency in handling data structures useful in Data Science[L3].
2304102L.CO.3: Apply the suitable methods of data computations on real time data[L3].
2304102L.CO.4: Interpret the different methods of data manipulation on real time data[L3].
2304102L.CO.5: Apply data visualization for real time data to get better insights[L3].

## COURSE ABSTRACT

Essentials of Data Science (EDS) is the First Year Semester-II course. This course aims at equipping learners to be able to provide the essence of Data Science by using python programming. In this course, firstly, the learners will learn python fundamentals required for Data Science. The learners are able to use different data organizational structures to store the real time data. Data computations are required to maintain the quality of data. EDS helps to learn different data computations. Data manipulations help in handling missing and noisy values in Data Processing. The learner will learn data storing, loading, cleaning, preparation, wrangling, transformation etc. Data visualization is the practice of translating information into a visual context, such as a map or graph which tends to identify the patterns, trends from the data. This course will increase the learner's interest in Data Science. The activity based learning is adapted to learn this course.

**PRACTICAL:Perform following experiments using python programming language.**

| **PRACTICAL NO.01** | | **6 HOURS** |
|---|---|---|

**Practice Lab Assignments:**

1. To accept an object mass in kilograms and velocity in meters per second and display its momentum. Momentum is calculated as e=mc2 where m is the mass of the object and c is its velocity.
2. Write a Python program for following conditions.
   - If n is single digit print square of it.
   - If n is two digit print square root of it.
   - If n is three digit print cube root of it.
3. Read the birth date and salary in rupees of employees. Perform data transformation for birthdate to age and also salary which is in rupees to salary in dollars using functions.
4. Print the reverse number of a given number,

**Lab Assignment:**

1. To accept students five courses marks and compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course.
   If student scores aggregate greater than 75 percentage, then the grade is distinction.
   If aggregate is greater than or equal to 60 and less than 75 then the grade if first division.
   If aggregate is greater than or equal 50 and less than 60, then the grade is second division.
   If aggregate is greater than or equal 40 and less than 50, then the grade is third division.
2. Solve the Fibonacci sequence using recursive function in Python.
3. Write a Python program to print different patterns.

**Self Study Assignment:**

Perform all statistical analysis (Average, Max, Min, Sum, on emplyoee data.

| PRACTICAL NO.02 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Perform all List Operations, Dictionary Operations.

**Lab Assignment:**

1. Select the number from the entered list and find its position in Python (use Linear Search).
2. Choose cricket team of eleven players find the captain of the team (consider tallest person as a captain) using dictionary.

**Self Study Assignment:** 1. Consider the student subjects marks are stored in the list. Find the total marks and percentage of students.

2. Perform all tuple operations.

| PRACTICAL NO.03 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Perform all the Numpy operations in python.

**Lab Assignment:**

Prepare/Take dataset for any real life application. Read a dataset into an array. Perform following operations on it as:

- Perform all matrix operations
- Horizontal and vertical stacking of Numpy Arrays
- Custom sequence generation
- Arithmetic and Statistical Operations, Mathematical Operations, Bitwise Operators
- Copying and viewing arrays
- Data Stacking, Searching, Sorting, Counting, Broadcasting

**Self Study Assignment:** For any real life application, perform advanced data operations such as image as array and image manipulations.

| PRACTICAL NO.04 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Perform all the pandas operations in python.

**Lab Assignment:** Read any real life dataset. Store the data into Data Frames. Identify 10 grains for the given dataset. Implement all 20 grains using Pandas methods. The Sample Grains for Sales Dataset as:

- Which was the best month for sales? How much was earned that month?
- Which product sold the most? Why do you think it did?
- Which city sold the most products?
- What Products are most often sold together?

**Self Study Assignment:** For any real life application, perform advanced Data Manipulation operations such as combining data, handling time series data.

| PRACTICAL NO.05 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Install MatPlotLib library. Draw basic graphs for sales dataset using MatPlotLib.

**Lab Assignment:**

For Titanic dataset, Perform data analysis. Identify 5 grains for a given dataset. Perform a data visualization for those grains using the MatPlotLib library. (Use any 5 different graphs with proper title, legends, axis names, etc.to map identified grains)

**Self Study Assignment:** 1. For any real life application, perform advanced graphs for data visualization such as Span Selector, Broken Barh-Broken Horizontal Bar plot, Watermarking Images with Matplotlib.

2. Apply Linear Regression and K-Nearest Neighbour Classifier on a real time dataset.

## TEXT BOOK


1. VanderPlas, J. (2016). Python data science handbook: Essential tools for working with data. " O'Reilly Media, Inc.".
2. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".
3. McKinney, W. (2017). Python for data analysis, " O'Reilly Media, Inc".
4. Brownley, C. W. (2016). Foundations for Analytics with Python: From Non-Programmer to Hacker. " O'Reilly Media, Inc.".


## REFERENCE BOOK


1. Mueller, J. P., & Massaron, L. (2019). Python for data science for dummies. John Wiley & Sons.
2. Grus, J. (2019). Data science from scratch: first principles with python. O'Reilly Media.
3. Kane, F. (2017). Hands-on data science and python machine learning. Packt Publishing Ltd.
4. Madhavan, S. (2015). Mastering python for data science. Packt Publishing Ltd.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF CIVIL ENGINEERING** | **W.E.F** | **AY:** - 2024 (Rev. (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Applied Mechanics |
| | **COURSE CODE** | 2303101T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2303101T.CEO.1: To define fundamental concepts and laws of rigid body mechanics.
2303101T.CEO.2: To state conditions of equilibrium for engineering structures.
2303101T.CEO.3: To describe kinematic parameters of rectilinear and curvilinear motion.
2303101T.CEO.4: To explain energy and momentum methods of kinetics”

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2303101T.CO.1: Determine the resultant of system of forces acting on bodies. [L1]
2303101T.CO.2: Calculate the support reactions and member forces for simple structures. [L2]
2303101T.CO.3: Analyse bodies in rectilinear and curvilinear motion. [L4]
2303101T.CO.4: Apply energy and momentum methods for kinetics problems. [L3]

## COURSE ABSTRACT

This course is built on the foundation and framework of mathematics and physics. The course requires students to have strong abstract thinking and reasoning skills. In addition, Concepts will be applied in this course from previous courses you have taken in basic math and physics. The course addresses the modeling and analysis of real world engineering applications and problem solving. In this course, we shall be learning about interaction between bodies dealing with STATICS and in the second part DYNAMICS students will study the motion of particles. Statics covers free body diagrams, equilibrium of rigid bodies, analysis of trusses and beams, discussion on friction, virtual work and stability. Dynamics deals with general plane motion of rigid bodies, use of translating and rotating motion frames of reference for analysis, plane kinetics and work energy principle.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Basics of Statics** | **7 HOURS** |

**Applications/Case Study:** Failure of any building, bridge etc.

**Contents:** Fundamental Concepts and Principles in mechanics, Force and force systems, Resolution, Resultant, and Moment of a force system; Equilibrium of a particle systems. Free body diagram (FBD). Equilibrium of rigid bodies.

**Self Study:** Observe the static objects around you and draw free body diagram and calculate resultant of same.

| | | |
|---|---|---|
| **UNIT 2** | **Applications of Statics** | **8 HOURS** |

**Applications/Case Study:** Determination of axial forces for industrial truss.

**Contents:** Types of supports and their reactions. Beam reactions, Analysis of cables, Analysis of trusses, and Analysis of frames. Centroid of plane laminas. Engineering applications of friction. Belt Friction, Wedge friction.

**Self Study:** Understanding following questions are expected from the students.

1. What does it mean for a design of members to be ”Statically indeterminable”?
2. What is a ”Two force Member”?
3. Which forces are allowed on a member?

| | | |
|---|---|---|
| **UNIT 3** | **Kinematics of particle** | **8 HOURS** |

**Applications/Case Study:** Falling Body and Projectile Motion Case Study.

**Contents:** Basic concepts in kinematics- Position, velocity, acceleration, jerk. Rectilinear motion with constant and variable acceleration. Connected body motions. Relative motion. Curvilinear motion in Cartesian coordinates and path coordinates.

**Self Study:** Study of gyroscopic motion.

| UNIT 4 | Kinetics of particle | 7 HOURS |
|---|---|---|

**Contents:** Kinetics- Equation of motion. Concept of work done, energy and power. Principle of work and energy. Conservation of energy. Principle of impulse and momentum. Conservation of momentum. Collisions- Direct central impact. Coefficient of restitution.

**Self Study:** Study of vehicle dynamics.

## TEXT BOOKS


1. Nelason, A. (2009). Engineering Mechanics: Statics and Dynamics. 2nd Edition, Tata McGraw-Hill Education.
2. Anil Kumar D. (2015). Engineering Mechanics: Statics Dynamics", 1st edition, Tata McGraw-Hill Education.


## REFERENCE BOOKS


1. Hibbeler, R. C. (2009). Gupta Ashok Engineering Mechanics: Statics Dynamics.", 14th Edition, Pearson Education Inc., Prentice Hall.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF CIVIL ENGINEERING | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Applied Mechanics |
| | COURSE CODE | 2303101L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2303101L.CEO.1: To provide students with hands-on experience and practical knowledge in the field of applied mechanics.

2303101L.CEO.2: To bridge the gap between theoretical concepts learned in the classroom and real-world applications.

2303101L.CEO.3: To develop a deep understanding of fundamental mechanics principles and their practical implications.through a combination of experiments and projects,"

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2303101L.CO.1: Develop a practical understanding of fundamental mechanics principles and apply theoretical knowledge to solve real-world engineering problems [L3].

2303101L.CO.2: Analyze, and interpret experimental data, and present results in a clear and organized manner [L4].

2303101L.CO.3: Design, conduct, and analyze experiments by effective collbrating with team members [L6].

2303101L.CO.4: Build ethical behavior in conducting experiments, handling data, and interacting with colleagues [L3]. "

## COURSE ABSTRACT

The Applied Mechanics Laboratory serves as a crucial platform for understanding fundamental principles and practical applications of mechanics in engineering. This abstract provides an overview of the objectives, methodologies, and potential outcomes of experiments conducted within this laboratory setting.The primary goal of the Applied Mechanics Laboratory is to provide students with hands-on experience in exploring and analyzing various mechanical phenomena. Through a series of carefully designed experiments, participants gain insights into the behavior of materials and structures under different loading conditions. The laboratory covers a diverse range of topics, including statics and dynamics.Experiments within the laboratory involve the use of state-of-the-art equipment and measurement tools to investigate the mechanical characteristics of materials such as metals, polymers, and composites. Static experiments focus on equilibrium conditions and the study of forces and moments, while dynamic experiments explore the dynamic response of structures to external forces.

| PRACTICALS/ACTIVITIES | | |
|---|---|---|
| **PRACTICAL NO.01** | **Parallelogram Law** | **2 HOURS** |
| To verify parallelogram law of force addition. | | |
| **PRACTICAL NO.02** | **Law of moments** | **2 HOURS** |
| To verify law of moments for parallel forces. | | |
| **PRACTICAL NO.03** | **Block Friction** | **2 HOURS** |
| To determine coefficient of static friction for a block on a plane. | | |
| **ACTIVITY NO.01** | **Truss model** | **2 HOURS** |
| To develop truss model. | | |
| **PRACTICAL NO.04** | **Belt Friction** | **2 HOURS** |
| To determine coefficient of static friction for a flat belt on a drum. | | |
| **PRACTICAL NO.05** | **Centroid 1D** | **2 HOURS** |
| To determine centroid of composite wire object. | | |
| **PRACTICAL NO.06** | **Centroid 2D** | **2 HOURS** |
| To determine centroid of composite plane lamina. | | |
| **ACTIVITY NO.02** | **Model making for Centroid** | **2 HOURS** |
| To develop the model for centroid. | | |
| **PRACTICAL NO.07** | **Projectile Motion** | **2 HOURS** |
| To analyze projectile motion in Cartesian coordinates. | | |
| **ACTIVITY NO.03** | **Model making for Projectile** | **2 HOURS** |
| To develop the model for projectile. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.08** | **Compound Pendulum** | **2 HOURS** |
| To determine mass moment of Inertia of compound pendulum. | | |
| **PRACTICAL NO.09** | **Fly Wheel** | **2 HOURS** |
| To analyse rotational motion of a flywheel about a fixed axis. | | |
| **ACTIVITY NO.04** | **Model of parachute** | **2 HOURS** |
| To develop the parachute model. | | |
| **PRACTICAL NO.10** | **Direct Central Impact** | **2 HOURS** |
| To determine coefficient of restitution for direct central impact. | | |
| **PRACTICAL NO.11** | **Final Exam** | **2 HOURS** |
| For all batches during the lab hours. | | |

**TEXT BOOKS**

1. Meriam, J. L., Kraige, L. G., & Bolton, J. N. (2020). Engineering mechanics: dynamics. John Wiley & Sons.

**REFERENCE BOOKS**

1. NIL

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF MECHANICAL ENGINEERING** | **W.E.F** | **AY:** - 2024 (Rev. (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Design Thinking |
| | **COURSE CODE** | 2309101T |
| | **COURSE CREDITS** | 1 |
| **RELEASED DATE :** | **REVISION NO** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2309101T.CEO.1: To utilize information collection tools to clearly define user centric problem.
2309101T.CEO.2: To apply SCAMPER tool to find diverse solutions.
2309101T.CEO.3: To choose one concept out of the selected alternatives by taking into consideration user centred design parameters.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2309101T.CO.1: Apply information gathering techniques to select user centric problem [L3].
2309101T.CO.2: Apply SCAMPER tool to find diverse solutions [L3].
2309101T.CO.3: Choose one concept out of the selected alternatives by taking into consideration user centred design parameters [L3].

## COURSE ABSTRACT

Design thinking is a powerful process of problem solving as it deals with human centred design approach. When design thinking approaches are applied to business, the success rate for innovation improves substantially. The course aim to imbibe understanding of the design thinking process and apply it to real-world problems while building their strong teamwork and communication skills. Students will learn to use the design thinking process to solve complex problems and create innovative solutions. Course covers topics such as research, ideation, prototyping, testing, and iteration. Students also learn to use a variety of design thinking tools, such as personas, journey maps, mind mapping, SWOT analysis, SCAMPER, Brainstorming, AEIOU framework etc. Students work in team to tackle real-world design challenges. So they learn how to communicate their ideas effectively and how to receive and give constructive feedback and present their design solutions in aclear and compelling manner. Upon completion of the course, students will have a deep understanding of the design thinking process and how to apply it to real-world problems. They will be able to use a variety of design thinking tools and techniques to generate and evaluate ideas, create prototypes, and test and refine their solutions. They will also have strong teamwork and communication skills, making them valuable members of any design team.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **FUNDAMENTALS OF DESIGN THINKING** | **2 HOURS** |

Introduction to design, types of design, Introduction to Design Thinking, Divergent Thinking, Convergent Thinking.
Various types of thinking: Critical thinking, Creative thinking, lateral thinking, Disruptive Thinking.
**Self Study:** Timeline.

| | | |
|---|---|---|
| **UNIT 2** | **HUMAN CENTRED DESIGN** | **2 HOURS** |

Introduction to Human Centred Design, Human Centred Design Phases, Human Centred Design Process, Human Centred Design case study, Planet centric Design.
**Self Study:** Customer Journey Map.

| | | |
|---|---|---|
| **UNIT 3** | **ANTHROPOLOGY** | **2 HOURS** |

Characteristics of Anthropology: Culture, holistic approach, field work, multiple theories and purposes of anthropology. Empathy and Ethnography.
**Self Study-** Ethnograpy: AEIOU Framework.

| | | |
|---|---|---|
| **UNIT 4** | **RESEARCH METHODOLOGY** | **3 HOURS** |

Design thinking Models & Methodology, General Problem Statement, Random check list, mind mapping, Categorization of random check list, Brainstorming of problem areas Research Methodology – Information gathering – Primary, Secondary Sources, data presentation, Preparation of survey forms, Survey Analysis, Drawing Inference.
**Self Study:** Likert Scale, Affinity Diagram, Reverse engineering of a research paper to identify all the essential elements of the research.

| UNIT 5 | IDEATION | 4 HOURS |
|---|---|---|
| SWOT analysis, Vein Diagram (User Desirability, Feasibility, Viability check) Drawing inferences, Translation of inferences into design criteria, specific problem statement, Ideation – free hand sketching drawing of simple form of products (Isometric views, layout, circuit diagram, Ideation sketches), Ergonomic and aesthetic consideration in design.<br>**Case Study:** SCAMPER, TRIZ. | | |
| **UNIT 6** | **PROTOTYPING** | **2 HOURS** |
| Concept validation, evaluation and detailing, Different methods of Prototyping, selection of right method of prototyping.<br>**Case Study:** Minimum Viable Product. | | |

## TEXT BOOKS


1. Yayici, E. (2016). Design thinking methodology book. ArtBizTech.
2. Mootee, I. (2013). Design thinking for strategic innovation: What they can't teach you at business or design school. John Wiley & Sons.
3. Lockwood, T. (2010). Design thinking: Integrating innovation, customer experience, and brand value. Simon and Schuster.
4. Marc, S. (2012). This is Service Design Thinking: Basics-Tools-Cases. Bis Publishers.


## REFERENCE BOOKS


1. Jones, J. C. (1992). Design methods. John Wiley & Sons.
2. Cross, N. (2011). Design thinking: Understanding how designers think and work. Berg.
3. Gonen, E. (2020). Tim brown, change by design: how design thinking transforms organizations and inspires innovation (2009). Markets, Globalization & Development Review, 4(2).
4. Melles, G., de Vere, I., & Misic, V. (2011). Socially responsible design: thinking beyond the triple bottom line to socially responsive and sustainable product design. CoDesign, 7(3-4), 143-154.
5. Kumar, V. (2012). 101 design methods: A structured approach for driving innovation in your organization. John Wiley & Sons.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF MECHANICAL ENGINEERING | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Design Thinking Lab |
| | COURSE CODE | 2309101L |
| | COURSE CREDITS | 1 |
| RELEASED DATE : | REVISION NO | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 20 | 40 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2309101L.CEO.1: To apply ethnographic framework to carryout design thinking project.
2309101L.CEO.2: To build prototype of alternative based on human centred design.
2309101L.CEO.3: To present design thinking project.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2309101L.CO.1: Apply ethnographic framework to carryout design thinking project [L3].
2309101L.CO.2: Evaluate most appropriate solution for defined user centric problem [L6].
2309101L.CO.3: Build the prototype of the most optimum solution [L3].

**COURSE ABSTRACT**

In Design thinking lab students will carry out all the steps involved in design thinking practically. The steps involved are empathy, problem definition, ideation, prototyping and testing. Students will engage in observing and understanding user needs within a specific domain. They will carry out primary and secondary research to gather relevant data and insights (empathy map and problem definition). This research will help students to define the specifications and requirements for the product. Using SCAMPER tool students will generate innovative ideas based on the identified needs and specifications (ideation). Evaluation of concepts will be carried out by using Pugh matrix and the concept which is having more weightage will be selected for creating a prototype (concept evaluation and testing). Using this prototype student will validate the solution by taking feedback from user(testing). In summary student will apply the tools taught during theory class to carry out their design thinking project.

| **PRACTICALS:(Project Work)** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Needs Finding (Observation of Domain)<br>**Self Study:** space Interaction. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Research methodology | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Product Specification<br>**Self Study:** RUTAG Project Exploration. | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Ideation | | |
| **PRACTICAL NO.05** | | **4 HOURS** |
| Concept Evaluation, Validation and Concept detailing<br>**Self Study:** Pugh Matrix. | | |
| **PRACTICAL NO.06** | | **6 HOURS** |
| Prototyping | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Documentation | | |

## TEXT BOOKS


1. Yayici, E. (2016). Design thinking methodology book. ArtBizTech.
2. Mootee, I. (2013). Design thinking for strategic innovation: What they can't teach you at business or design school. John Wiley & Sons.
3. Lockwood, T. (2010). Design thinking: Integrating innovation, customer experience, and brand value. Simon and Schuster.
4. Marc, S. (2012). This is Service Design Thinking: Basics-Tools-Cases. Bis Publishers.


## REFERENCE BOOKS


1. Jones, J. C. (1992). Design methods. John Wiley & Sons.
2. Cross, N. (2011). Design thinking: Understanding how designers think and work. Berg.
3. Gonen, E. (2020). Tim brown, change by design: how design thinking transforms organizations and inspires innovation (2009). Markets, Globalization & Development Review, 4(2).
4. Melles, G., de Vere, I., & Misic, V. (2011). Socially responsible design: thinking beyond the triple bottom line to socially responsive and sustainable product design. CoDesign, 7(3-4), 143-154.
5. Kumar, V. (2012). 101 design methods: A structured approach for driving innovation in your organization. John Wiley & Sons.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | DATA VISUALIZATION |
| | COURSE CODE | 2304162T |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

## COURSE OBJECTIVES :

2304162T.CEO.1: To introduce students to the fundamental problems, concepts, and approaches in the design and analysis of data visualization systems

2304162T.CEO.2: To familiarize students with the stages of the visualization pipeline, visualization paradigms,techniques, and tools.

2304162T.CEO.3: To Design effective data visualizations in order to provide new insights and communicate information to the viewer.

2304162T.CEO.4: To implement the effectiveness of visualizations for specific data, task, and user types.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2304162T.CO.1: Apply Data Exploration, Profiling techniques, cleaning tables on given dataset [L3].

2304162T.CO.2: Identify grains for the given domain [L3].

2304162T.CO.3: Choose appropriate graphs for given grains [L3].

2304162T.CO.4: Construct dashboard and story boards [L3].

## COURSE ABSTRACT:

Data Visualization kingpins exploratory presentation of data. Course direct learner to connect with data, grain identification, data management with the help of filters, data visualization with the help of charts, data analysis with the help of table calculations, and at the end dynamic representation concluding the result with the help of dynamic dashboard and story boards.

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **DATA EXPLORATION** | **06 HOURS** |
| **Applications/Case Study: North wind dataset**<br>**Contents:** Data visualization fundamentals, need for data visualization, Data Exploration, Data profiling, Preprocessing tables and data cleaning, Importance dynamic dashboard, Significance & amp; applications of each graph illustrate with example. | | |
| **UNIT 2** | **DATA ANALYSIS AND VIEW ENHANCEMENT** | **05 HOURS** |
| **Applications/Case Study: Titanic data set**<br>**Contents:** table calculations,Format worksheet: Font setting, Border, Line, Format specific setting: Number, Field labels, Annotation: Add and Mark, Positioning, Area, Format, Remove, Labels: Display, Show and hide individual mark label, move label. Descriptive analysis and its co-copyrightResize table: Resize entire table, Rows, columns, Cells. | | |
| **UNIT 3** | **DASHBOARD AND STORY BOARD** | **04 HOURS** |
| **Applications/Case Study: Football tournament data set**<br>**Contents:** Significance and application of each graph, Descriptive analysis and its significance. | | |

**Text book**


1. Sharada Sringeswara; Purvi Tiwari; U. Dinesh Kumar, (2022),"Data Visualization: Storytelling Using Data", Wiley Publication.


**REFERENCE BOOKS**


1. Appala Srinuvasu Muttipati, (2023), " Hand Book on Data Visualization: Easy to quick practices", Notion Press, ISBN: 9798891862920.
2. Joshua N.Milligan. (2015), "Learning Tableau 2020", Packt Publication Limited, ISBN-978-1784391164.


**E - Resources**

1. https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | DATA VISUALIZATION LAB |
| | COURSE CODE | 2304162L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 20 | 40 |

## COURSE OBJECTIVES :

2304162L.CEO.1: To introduce students to the fundamental problems, concepts, and approaches in the design and analysis of data visualization systems

2304162L.CEO.2: To familiarize students with the stages of the visualization pipeline, visualization paradigms,techniques, and tools.

2304162L.CEO.3: To Design effective data visualizations in order to provide new insights and communicate information to the viewer.

2304162L.CEO.4: To implement the effectiveness of visualizations for specific data, task, and user types.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2304162L.CO.1: Apply Data Exploration, Profiling techniques, cleaning tables on given dataset [L3].

2304162L.CO.2: Identify grains for the given domain [L3].

2304162L.CO.3: Choose appropriate graphs for given grains [L3].

2304162L.CO.4: Construct dashboard and story boards [L3].

## COURSE ABSTRACT:

Data Visualization kingpins exploratory presentation of data. Course direct learner to connect with data, grain identification, data management with the help of filters, data visualization with the help of charts, data analysis with the help of table calculations, and at the end dynamic representation concluding the result with the help of dynamic dashboard and story boards.

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **Implement Data connection for the given case study.** | **2 HOURS** |
| - | | |
| **PRACTICAL NO.02** | **Identiftcation of grains for any given application/case study e.g Walmart /supermarket for analysis.** | **2 HOURS** |
| . | | |
| **PRACTICAL NO.03** | **Concepts and demonstration: Implement data management for enhancing customer experience through**<br>1. Filter Addition<br>2. Quick Filters<br>3. Global Filters<br>4. Context Filters<br>5. Sorting<br>6. Grouping | **2 HOURS** |
| . | | |
| **PRACTICAL NO.04** | **Concepts and demonstration: Construct View based on the geographical data visualization with the help of**<br>1. Toolbar<br>2. Dimensions and Measures field<br>3. Folders | **2 HOURS** |
| . | | |

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **Discover basic and advanced view types using**<br>1. Pie charts<br>2. Stacked bar charts<br>3. Histogram<br>4. Line chart<br>5. Area chart<br>6. Scatter plot<br>7. Box and Whisker plot<br>8. Bullet chart<br>9. geographical data charts<br>10. geospatial charts<br>11. tree charts<br>12. heat maps<br>13. pareto charts | **4 HOURS** |
| . | | |
| **PRACTICAL NO.06** | **Concepts and demonstration: Table calculations and measures**<br>1. Addressing and Partitioning table calculations<br>2. Quick table calculations<br>3. Custom table calculations<br>4. Creation of calculated filed<br>5. calculated measures | **4 HOURS** |
| - | | |

| | | |
|---|---|---|
| **PRACTICAL NO.07** | **Concepts and demonstration: create a professional dashboard and story boards by applying**<br>1. Worksheet Formatting<br>2. Format specific setting<br>3. Resize table<br>4. Copy format to other worksheet etc. | **4 HOURS** |
| **PRACTICE ANY 2** | **Concepts and demonstration: create a professional dashboard and story boards on given case study** | **10 HOURS** |

**Text book**

1. Sharada Sringeswara; Purvi Tiwari; U. Dinesh Kumar, (2022),"Data Visualization: Storytelling Using Data", Wiley Publication.

**REFERENCE BOOKS**

1. Appala Srinuvasu Muttipati, (2023), " Hand Book on Data Visualization: Easy to quick practices", Notion Press, ISBN: 9798891862920.
2. Joshua N.Milligan. (2015), "Learning Tableau 2020", Packt Publication Limited, ISBN-978-1784391164.

**E - Resources**

1. https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Discrete Structure |
| | COURSE CODE | 2304111T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

## COURSE OBJECTIVES :

2304111T.CEO.1: To learn the basics of set theory and propositional logic.
2304111T.CEO.2: To use appropriate set, function, or relation models to analyze practical examples.
2304111T.CEO.3: To apply the Model and analyze computational processes using combinatorial methods.
2304111T.CEO.4: To explore several logical possibilities and algebraic structures.
2304111T.CEO.5: To understand and solve problems on graphs and trees.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2304111T.CO.1: Develop the notion of mathematical thinking, and mathematical proofs in problem analysis [L2].
2304111T.CO.2: Apply propositional logic to elementary mathematical arguments to ensure reasoning [L3].
2304111T.CO.3: Solve problems using Permutations, combinations,relations, and functions [L2].
2304111T.CO.4: Apply the concepts of graphs and trees for problem-solving [L3].

**COURSE ABSTRACT:**

The course will be an introduction to Discrete Mathematics which comprises the essentials for a computer science student to go ahead and study any other topics in the subject. The emphasis will be on problem-solving as well as proofs. The course will provide motivational illustrations and applications throughout the course. The course assumes no prerequisites except for high school-level arithmetic and algebra.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **BASIC SETS THEORY** | **06 HOURS** |

**Applications/Case Study:** Bank Management System, Online Shopping System: Specialization and Generalization

**Contents:** Sets, Basic operations of sets, Finite and Infinite sets, Principle of Inclusion and exclusion, power sets, countable and uncountable sets. .

**Self Study:** Multi-Sets, Use of Multi Sets

**Further Readings:**Applications of Mathematical Induction

| | | |
|---|---|---|
| **UNIT 2** | **PROPOSITIONAL LOGIC** | **06 HOURS** |

**Applications/Case Study:** Applications of Propositional Logic in AI, Logic Puzzles

**Contents:** Propositional Logic: logic, Propositions, Conditional Propositions, Logical Connectivity, prepositional calculus, Universal and Existential Quantifiers, and Rules of inference.

**Self Study:**Propositional Equivalences.

**Further Readings:**Application of propositional logic in Boolean Algebra, Logic Circuits.

| | | |
|---|---|---|
| **UNIT 3** | **RELATIONS** | **06 HOURS** |

**Applications/Case Study:** Relation between sets and associated functions

**Contents:**Relations: Definition and Properties of Binary Relations, Closure of relations, Warshalls algorithm, Equivalence relations and partitions, Partial ordering relations,Hasse Diagram, and lattices, Chains and Antichains.

**Functions:** Functions, Surjective, Injective and Bijective functions, Composition of functions.

**Self Study:** Application Recurrence Relation for Analysis of Algorithm.

**Further Readings:**Linear Recurrence Relations with Constant Coefficients.

| | | |
|---|---|---|
| **UNIT 4** | **COUNTING METHODS AND THE PIGEONHOLE PRINCIPLE** | **06 HOURS** |

**Applications/Case Study:** Library Management System, Diet Planning System

**Contents:** The Basics of Counting, rule of Sum and Product, Permutations and Combinations , Binomial Coefficients and Combinatorial Identities, and pigeonhole principle.

**Self Study:** Algorithms for generating Permutations and Combinations..

**Further Readings:**Discrete Probability Theory.

| UNIT 5 | ALGEBRAIC STRUCTURES | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Cryptography

**Contents:** Groups theory: Algebraic Systems, Groups, Semi-Groups, Monoids, Subgroups, Permutation Groups, Codes and Group codes, Isomorphism and Auto-morphisms, Homomorphism.

**Self Study:** Euclidean algorithm.

**Further Readings:** Abelian and cyclic groups.

## TEXT BOOKS


1. R. Johnsonbaugh (2009). *Discrete Mathematics*. 5th Edition, Pearson Education, ISBN 817808279- 9 C.
2. Liu and D. P. Mohapatra (2008). *Elements of Discrete Mathematics*. 6th TataMcGraw-Hill,ISBN 10:0-07-066913-9
3. Kenneth H. Rosen (2007). *Discrete Mathematics and its Applications*. 6th McGraw-Hill, ISBN 978-0-07-288008-3


## REFERENCE BOOKS


1. N. Biggs (2002). *Discrete Mathematics*. 3rd Edition, Oxford University Press.
2. E. Goodaire and M. Parmenter *Discrete Mathematics with Graph Theory*. 2nd Edition, Pearson Education.
3. Semyour Lipschutz Marc Lipson *Discrete Mathematics*. 3rd Edition, McGraw-Hill.
4. B. Kolman, R. Busby and S. Ross *Discrete Mathematical Structures*. 4th Edition, Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING | W.E.F | AY: - 2024 (Rev. (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Creative Technologies Lab |
| | COURSE CODE | 2307183L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2307183L.CEO.1: Develop insight for Futuristic Technology Development.
2307183L.CEO.2: Become familiar with Digital Technologies like AI, AR, Block chain, Cloud, IOT
2307183L.CEO.3: Explore various developments in Robotics, EV, Drone and AE/CE, ZEB.
2307183L.CEO.4: Build a solution for real life problem based on futuristic technologies
2307183L.CEO.5: Design and Develop a Digital Portfolio using Web Technology

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2307183L.CO.1: Articulate the significance of United Nations Organization (UNO) Goals. [L2]
2307183L.CO.2: Develop a Digital Portfolio using Web Technology. [L3]
2307183L.CO.3: Illustrate the use cases of emerging technologies. [L2]
2307183L.CO.4: Develop a Laboratory project based on future technologies in a team. [L3]

**COURSE ABSTRACT**

This is compulsory course with choice-based modules aims to focus on introduction to the futuristic developing engineering technologies. The students will gain insight to technology development and multidisciplinary industrial environment at introductory level. The students will comprehend different technologies in instructional interaction. They will develop Digital portfolio using Web Technology. The students will have ample choice to select futuristic technology of their interest. In order to experience joyful learning, students will apply chosen futuristic technology for real life problems. Alongside demonstrations and there will be hands on training on chosen futuristic technology. They will develop a laboratory project based on futuristic technologies Like Artificial Intelligence (AI), Block-chain Technology, Electric Vehicles (EV), Internet of Things (IOT), Cloud Computing, Augmented Reality (AR), Robotics and Drones, Zero Energy Building (ZEB) and Affordable and Clean Energy (AE/CE).

**PRACTICALS:**

**Module 1: INSTRUCTIONAL MODULE (16 HOURS) [COMPULSORY]**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Sustainable Technology Development** | **1 HOURS** |

Need for Technology, Overview of Technology Development. Advanced Technologies by year 2030, UNO Goals, Priorities, Open problems, Sustainable Technology.
**Application/Case Study:** Zero Hunger (UNO Goals: Sustainable Development Goal 2).

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Digital Portfolio** | **1 HOURS** |

Significance of digital portfolio, Methods for making effective digital portfolio.
**Application/Case Study:** Sample Digital portfolios of students and Professionals.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Digital Engineering** | **7 HOURS** |

Introduction to Artificial Intelligence & Machine Learning, Types of Learnings. Basics of Big Data, significance of it. Introduction to Internet of things, IoT overview, Concept of Edge Computing, IOT Edge computing solutions. Need and importance of Cyber Security, Aspects of cyber-Security.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Overview of Emerging technologies** | **7 HOURS** |

Digital Technology Domain: Introduction to Block-chain technology, Fundamental concepts of Cloud computing, Concept of Augmented Reality and applications.
Industry Automation Domain: Introduction to Robotics and Automation, Robot classification, Robot anatomy, Introduction to Drone, Anatomy of a Customized Drone Technology.
Renewable Energy Domain: Solar, Wind, Biofuels, Energy types of fuel cell. Electrical Vehicle (EV), Overview of different systems in EV, Types, Concept of Zero Energy Building (ZEB), Comparison ZEB and Green building, Net zero site energy use, Net zero site source energy use, Net zero energy emissions, Net zero cost Application

| Module 2: WEB TECHNOLOGY MODULE (14 HOURS) [COMPULSORY] | | |
|---|---|---|
| **PRACTICAL NO.01** | **Basic HTML** | **4 HOURS** |
| Web 1.0, 2.0, 3.0, 4.0, Basic html tags, formatting tags, color tags, Div and span tags , Ordered list, Unordered list, Image tags, URL tag, table , Form, Hyperlinks. | | |
| **PRACTICAL NO.02** | **Cascading Style Sheets-CSS** | **4 HOURS** |
| Cascading Style Sheets-CSS, Multiple style sheets, Web page Layout and website Designs. | | |
| **PRACTICAL NO.03** | **Digital Portfolio** | **6 HOURS** |
| One-page/multi-page portfolio using HTML, Projection of information, Personal information, Projects, Achievements, Contact details etc. | | |

| Module-3 ADVANCED TECHNOLOGY MODULE* (16 HOURS) [CHOICE BASED] | | |
|---|---|---|
| * Student will select any one module out of Ten | | |
| **MODULE NO.3A** | **Artiftcial Intelligence (AI)** | **16 HOURS** |
| PRACTICAL-1 | Introduction to AI | 02 HOURS |
| PRACTICAL-2 | Image Processing-Object Recognition | 04 HOURS |
| PRACTICAL-3 | Machine Learning- Classification/Prediction | 04 HOURS |
| LAB PROJECT | Lab Project based on AI Application | 06 HOURS |
| **MODULE NO.3B** | **Block Chain Technology** | **16 HOURS** |
| PRACTICAL-1 | Introduction to Block Chain | 02 HOURS |
| PRACTICAL-2 | Development and Deployment of smart contact | 04 HOURS |
| PRACTICAL-3 | Creation of contact users | 04 HOURS |
| LAB PROJECT | Lab Project based on Block Chain Technology | 06 HOURS |
| **MODULE NO.3C** | **Cloud Computing** | **16 HOURS** |
| PRACTICAL-1 | Creation of AWS account, Service models | 02 HOURS |
| PRACTICAL-2 | Deployment and configuration management | 04 HOURS |
| PRACTICAL-3 | AWS instance on AWS cloud, Deployment of web server | 04 HOURS |
| LAB PROJECT | Lab Project based on Cloud Computing Technology | 06 HOURS |
| **MODULE NO.3D** | **Augmented Reality** | **16 HOURS** |
| PRACTICAL-1 | Introduction to Augmented Reality | 02 HOURS |
| PRACTICAL-2 | Objects, Physics, Light intensity adjustments, Scripts | 04 HOURS |
| PRACTICAL-3 | Development of 3D project and building application | 04 HOURS |
| LAB PROJECT | Lab Project based for Augmented Reality | 06 HOURS |

| MODULE NO.3E | Internet of Things (IOT) | 16 HOURS |
|---|---|---|
| PRACTICAL-1 | Hardware and Software Simulation Environment, Sensor and Actuators | 02 HOURS |
| PRACTICAL-2 | Switch Networking with WiFi module | 04 HOURS |
| PRACTICAL-3 | IoT, Cloud Platforms for IOT | 04 HOURS |
| LAB PROJECT | Lab Project based on IOT | 06 HOURS |
| **MODULE NO.3F** | **Robotics** | **16 HOURS** |
| PRACTICAL-1 | Introduction Components, types components | 02 HOURS |
| PRACTICAL-2 | Sensors, Actuators, Controller and Circuit | 04 HOURS |
| PRACTICAL-3 | Block code | 04 HOURS |
| LAB PROJECT | Lab Project based Robotics | 06 HOURS |

| MODULE NO.3G | Drone Technology | 16 HOURS |
|---|---|---|
| PRACTICAL-1 | Battery, Motors, BLDC, Power rating, losses | 02 HOURS |
| PRACTICAL-2 | Flight controllers, Pixhawk, Mamba Controllers | 04 HOURS |
| PRACTICAL-3 | Propellers, Assembly | 04 HOURS |
| PROJECT | Lab Project based on Drone Applications | 06 HOURS |
| **MODULE NO.3H** | **Affordable and Clean Energy** | **16 HOURS** |
| PRACTICAL-1 | Proton Exchange Membrane Fuel cell | 02 HOURS |
| PRACTICAL-2 | Microbial Fuel cell | 04 HOURS |
| PRACTICAL-3 | Open air cathode type fuel cell for car | 04 HOURS |
| LAB PROJECT | Lab Project for Affordable and Clean Energy | 06 HOURS |

| | | |
|---|---|---|
| **MODULE NO.3I** | **Electric Vehicles** | **16 HOURS** |
| PRACTICAL-1 | EV Motors and controllers, Battery pack | 02 HOURS |
| PRACTICAL-2 | Assembly and Working of Two-Wheeler EV | 04 HOURS |
| PRACTICAL-3 | Field Visit to Charging Station | 04 HOURS |
| LAB PROJECT | Lab Project for Electric vehicles | 06 HOURS |
| **MODULE NO.3J** | **Zero Energy Building** | **16 HOURS** |
| PRACTICAL-1 | Calculation of Carbon Footprint, Greenness | 02 HOURS |
| PRACTICAL-2 | Calculation of Electricity bill of Family / Hostel/ College Buildings | 04 HOURS |
| PRACTICAL-3 | Build It Green (PPT/ Video Presentation) | 04 HOURS |
| LAB PROJECT | Model Making | 06 HOURS |

**Continuous Assessment (CA) (35 Marks)**

1. Activity on Sustainability (05 Marks)
2. Activity on Uno goals (10 Marks)
3. *Certification with Online/Offline/Hybrid Course on Future Skills or Future Technologies (20 Marks)

***Certiftcations [Compulsory for every student]**

1. An Industrial or Academic certification course from Industries Agencies of repute will award 20 Marks.
2. The applicable Certification courses will be announced before the start of semester. The students must register for these courses and complete within the time frame announced.
3. The Institute is having collaborations with different agencies like NASSCOM, IBM, IUCEE etc. The applicable courses will be informed to the students.

**Laboratory Assessment (PR): (40 Marks)**

**Jury (Laboratory Project and Assignment Presentation Exam)**

1. Lab Experiments, Continuous Assessment activities as applicable in respective Modules (10 Marks).
2. Model Making, Poster presentation, Technical Article, Blog, Physical System Development (Basic) etc. activities as applicable in respective Modules (15 Marks).
3. Presentation of Digital portfolio- Presentation of all assignments and activities in the portfolio. (Personal Website). (15 Marks).

**TEXT BOOKS**


1. Solem, J. E. (2012). Programming Computer Vision with Python: Tools and algorithms for analyzing images. " O'Reilly Media, Inc.".
2. Vinod Chandra S.S., Hareendran A. S. (2014) Artificial Intelligence and Machine Learning. Prentice Hall India Learning Private Limited.
3. Hoff, T. (2017) Explain the cloud like I'm 10: Learn the inner-secrets behind Kindle, Netflix, AWS, Apple, Facebook, and Google. United States: Possibility Outpost Inc.
4. Garren A. (2017). AWS: A Beginner's Guide to the Basics of Amazon Webservice.
5. Soni, V. (2022). IOT for beginners: Explore IOT architecture, working principles, IOT devices, and various real IOT projects. Inde (BPB Publications).
6. Ford, M. (2016). Rise of the robots: Technology and the threat of a jobless future. Basic Books.
7. Yasodharan R. (2016). Basics of Robotics: To know all about Robotics. (Online).
8. Davies, B. (2016). In Build a drone: A step-by-step guide to designing, constructing, and flying your very own drone. essay, Skyhorse Publishing.
9. Abell, T. (2017). All about drones (Cutting-Edge Technology). North Star Editions.
10. Sandvik, K. B., & amp; Jumbert, M. G. (2016). The good drone (Emerging Technologies, Ethics and International Affairs). Routledge.
11. Liljequist, B., McLennan, F. (2016). The power of Zero: Learning from the world's leading Net Zero Energy Buildings. Ecotone Publishing.
12. Liu H. (2006). Principles of Fuel Cells. Taylor & Francis.
13. Patel N. (Editor). (2021). Electric Vehicles: Modern Technologies and Trends. Springer.
14. Miles M. (2022). The future in AR (augmented reality) for beginners. Online.

**REFERENCE BOOKS**


1. UNITED NATIONS. (2021). Technology and innovation report 2021: Catching technological waves . United Nations Publications. https://unctad.org/system/files/official-document/tir2020_en.pdf.
2. Burrows, M. (2012). Global trends 2030: Alternative worlds. US National Intelligence Council. https://www.dni.gov/files/documents/GlobalTrends_2030.pdf.
3. Open-source reference examples of digital portfolio. https://github.com/smaranjitghose/awesome-portfolio-websites https://www.freecodecamp.org/news/how-to-build-a-developer-portfolio-website/

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for
# Second Year
# Bachelor of Technology
# (Computer Engineering)

## NEP REVISION

(With Effect from Academic Year: )

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| SECOND YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: III (COMPUTER ENGINEERING)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304212T | Data Structures | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| PCC | 2304214L | Programming Lab | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| PCC | 2304221T | Computer Organization & Architecture | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2304221L | Computer Organization & Architecture Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| PCC | 2304218T | Computer Graphics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2304218L | Computer Graphics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| VSEC | 2304261L | Problem Solving Using Object Oriented Programming (C++) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2304262L | Problem Solving Using Object Oriented Programming (Java) | | | | | | | | | | |
| HSSM VEC | 2301287 | Universal Human Values-II | 1 | 4 | - | - | - | 25 | - | 75 | 100 | 3 |
| HSSM MEC | 2301276 | Entrepreneurship Skills | 1 | 2 | - | - | - | 25 | 20 | 30 | 75 | 2 |
| OE | 230125XT | Applied Mathematics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | *OE List | Open Elective Course | | | | | | | | | | |
| | 230125XL | Applied Mathematics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | *OE List | Open Elective Course Lab | | | | | | | | | | |
| ELC PRJ | 2304291L | Project Design | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| TOTAL | | | 11 | 22 | - | | | | | | 825 | 22 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| SECOND YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| SEMESTER: IV (COMPUTER ENGINEERING) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2304219T | Advanced Data Structures | 2 | - | - | 15 | 20 | 40 | - | - | 75 | | 2 |
| | 2304219L | Advanced Data Structures Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| PCC | 2304216T | Database Management System | 3 | - | - | 30 | 20 | 50 | - | - | 100 | | 3 |
| | 2304216L | Database Management System Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| PCC | 2304220T | Theory of Computation | 3 | - | - | 30 | 20 | 50 | - | - | 100 | | 3 |
| VSEC | 2304268L | Object Oriented Programming (Core Java) | - | 4 | - | - | - | - | 35 | 40 | 75 | | 2 |
| | 2304269L | Enterprise Application Development (Advanced Java) | | | | | | | | | | | |
| MDM | *MDM List | MDM Course-I | 2 | - | - | 15 | 20 | 40 | - | - | 75 | | 2 |
| | *MDM List | MDM Course-I Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| OE | 23BD251L | Prototyping | - | 4 | - | - | - | - | 35 | 40 | 75 | | 2 |
| | *OE List | Open Elective Course | 2 | - | - | 35 | | 40 | - | - | | | |
| HSSM VEC | 2301286T | Environmental Science | 2 | - | - | 35 | - | 40 | - | - | 75 | | 2 |
| ELC PRJ | 2304292L | Project Implementation | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| ELC SI | 2304296L | Internship (Life And Soft Skills) | - | - | - | - | - | - | - | 75 | 75 | | 2 |
| Audit | 2301281A | Indian Constitution | 1 | - | - | - | - | - | - | - | Audit | | |
| TOTAL | | | 15 | 16 | - | | | | | | 850 | | 22 |

*Two Credit Internships need to be completed after Completion of the Second Year.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2024 - 2025 (Rev. (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | DATA STRUCTURES |
| | **COURSE CODE** | 2304212T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | 2.1 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** Knowledge of Fundamentals of Computing

**COURSE OBJECTIVES :**

2304212T.CEO.1: To explain fundamental data structures and their applications in programming and problem solving.
2304212T.CEO.2: To illustrate abstract data representation methods.
2304212T.CEO.3: To build the ability to synthesize and analyze algorithms.
2304212T.CEO.4: To explain effective management of linear data structures.
2304212T.CEO.5: To demonstrate various techniques of searching and sorting.
2304212T.CEO.6: To build the ability to identify appropriate data structure for the specified problem.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304212T.CO.1: Explain the working of linear data structures. [L2].
2304212T.CO.2: Apply concept of Arrays for developing various applications.[L3].
2304212T.CO.3: Choose suitable type of linked list for solving problems.[L3].
2304212T.CO.4: Make use of Stack and Queue for scenario based applications.[L3].
2304212T.CO.5: Apply appropriate searching and sorting algorithm to solve real world problems. [L3].
2304212T.CO.6: Implement the concepts of hashing for solving real world problems. [L3].

**COURSE ABSTRACT:**

The basic aim of the course is to provide the knowledge of organizing and managing the data in the system. The goal is to make students understand the concept of data organization, management, abstraction, re-usability and efficient processing to retrieve useful information. Fundamentals of primitive data structures, various operations and related algorithms, applicability of data structures in real time applications are all covered in the syllabus.

**THEORY COURSE CONTENTS**

| UNIT 1 | INTRODUCTION TO DATA STRUCTURES | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Social networking, Recommendation system , Map applications.

**Contents:** Introduction to data structures, data objects, Abstract Data Types (ADT). Classification of data structures: - linear and Non-linear, static and dynamic, persistent and ephemeral data structures. Introduction to algorithms, Characteristics, Design Strategy (Introduction): - Greedy, Backtracking Divide Conquer, Dynamic Programming, Branch and Bound, Brute Force and Randomized Algorithm. Algorithmic complexities: - time and space complexity (iterative and recursive algorithms), Classification of algorithmic complexities (constant, linear, quadratic, cubic, exponential and factorial). Efficiency of algorithms, Big O, theta and omega notations with its significance. Introduction to Array: - Sequential Organization, Array as ADT, Representation and address calculation. Multidimensional Array, Operations on Array, Polynomial Representation and Sparse Matrix Representation.

**Self Study:-** Arrays in Image Processing.

**Further Readings:-** Arrays in Game Playing, Array and Database.

| UNIT 2 | LINKED LIST | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Process management in Linux, Account Management System, Shuffle merging system for set of two integer sets

**Contents:** Introduction to Linked lists, Linear Data Structure using linked Organization, Comparison of sequential and linked list organizations Linked List as ADT, Types:- Singly linked list, Doubly linked list, Singular and Doubly Circular linked list). Memory representation of linked list. Operations on linked list: insertion, deletion, traversing, searching, concatenation, merging and sorting, Polynomials Representation: - Ordered List, Polynomial Addition Multiplication. Generalized Linked List (GLL) :- concept, representation of polynomial and sets using GLL.

**Self Study:-** Garbage collection and linked list

**Further Readings:-** Web indexing using linked list

| UNIT 3 | STACK | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Josephus problem.

**Contents:** : Introduction to Stack, Stack as ADT, Representation and implementation of stack using array and Linked List, Multiple Stacks. Operations on stack, Applications: - Expression Evaluation and Conversion. Recursion: - Concept and Variants, Application: Tower of Hanoi. Backtracking:- Concept and use of stack in Backtracking, Application: 8-Queens Problem.

**Self Study:-** Role of stack in memory management.

**Further Readings:-** Concept of Back Stack.

| UNIT 4 | QUEUE | 08 HOURS |
|---|---|---|

**Applications/Case Study:** CPU Schedulong, Syntax checker system for matching braces, Maze solving system.

**Contents:** Introduction to Queue, Queue as ADT, Types: - Linear, Circular, Doubly-ended and Priority Queue. Representation and implementation of queue using array and linked list, Operations on Queue, Multiple Queues.

**Self Study:-** Concurrent Priority Queues.

**Further Readings:-** Bandwidth Management and Data Compression using Priority Queue.

| UNIT 5 | SEARCHING AND SORTING TECHNIQUES | 07 HOURS |
|---|---|---|

**Contents:** Searching:- Linear Search, Binary Search, Fibonacci Search and Sentinel Search.

Sorting: - Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Radix Sort and Shell Sort.

**Self Study:-** Bucket Sort.

**Further Readings:-** Tim Sort.

| UNIT 6 | HASHING TECHNIQUES | 06 HOURS |
|---|---|---|

**Contents:** Hash table and hash map, hash function, bucket, collision, probe, overflow, open hashing, closed hashing, perfect hash function, load density, full table, load factor, rehashing.

hash functions :- properties of good hash function,types of hash function(division, multiplication, extraction, mid - square, folding and universal).

Collision resolution strategies - open addressing and closed addressing(separate chaining). (with and without replacement).

**Self Study:-** Extendable hashing.

**Further Readings:-** Locality sensitive hashing.

## TEXT BOOKS


1. E. Horowitz S. Sahani, D. Mehta.(2018).*Fundamentals of Data Structures in C++, 10th Edition, Universities Press. ISBN-13:978-8173716065*.
2. T. Cormen, C Leiserson, R. Rivest, C Stein.(2016) *Introduction to Algorithms, 7th Edition, MIT press. ISBN-13:978-0262533058.* .
3. Michael T. Goodrich, Roberto Tamassia, David M. Mount.(2018).*Data Structures and Algorithms in C++, 5th Edition, John Wiley Sons. ISBN-13: 978-0470383278* .


## REFERENCE BOOKS


1. Seymour Lipschutz.(2014).*Data Structures with C, Revised First Edition, Schaum's Outline Series. ISBN 13: 978-1259029967*
2. Richard F. Gilberg, Behrouz A Forouzan. (2016).*Data structures- A Pseudocode Approach with C++, 4th Edition , Cengage l earning. ISBN-13: 9780534390808.* .
3. E.Horowitzs S. Sahani, S. Rajashekharan. (2015).*Fundametals of Computer Algorithms, Universities Press. ISBN-13:978-8 173716126.*
4. Debasis Samanta. (2012).*Classic Data Structures, 2nd Edition, TMH. ISBN-13: 978-8120337312*


## E-R ESOURCES

1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106106127

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2024 - 2025 (Rev. (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | PROGRAMMING LABORATORY |
| | **COURSE CODE** | 2304214L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE KNOWLEDGE :** Foundation of Computing

**COURSE OBJECTIVES :**

2304214L.CEO.1: To explain fundamental data structures and their applications in programming and problem solving.
2304214L.CEO.2: To illustrate abstract data representation methods.
2304214L.CEO.3: To build the ability to synthesize and analyze algorithms.
2304214L.CEO.4: To build the ability to identify appropriate data structure for the specified problem.
2304214L.CEO.5: To demonstrate various techniques of searching and sorting.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304214L.CO.1: Develop applications using arrays. [L3].
2304214L.CO.2: Choose suitable type of linked list for various applications. [L3].
2304214L.CO.3: Build scenario based applications using stack and queue. [L3].
2304214L.CO.4: Solve given problems using searching and sorting techniques. [L3].
2304214L.CO.5: Apply suitable hashing techniques for solving given problems. [L3].

**COURSE ABSTRACT:**

The basic aim of the course is to make students understand concept of implementing abstract data representation for organizing and managing the data efficiently. Implementation of primitive data structures, various operations and related algorithms, applicability of data structures in real time applications are all covered in the syllabus.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **ARRAYS** | **4 HOURS** |
| Design and implement a program to read, display, insert, update and delete operations on data objects using array for any one of the following application:-<br>1. Customer Management System<br>2. Aadhar Card Management System<br>3. Library Management System<br>**Self-Study:-** Practice Problem No 1 | | |
| **PRACTICAL NO.02** | **2D ARRAYS** | **4 HOURS** |
| Implement a program for storing a sparse matrix using 2-D Array for following operations:-<br>1. Compute transpose of matrix<br>2. Compute fast transpose of matrix<br>3. Add and multiply two sparse matrices<br>**Self-Study:-** Practice Problem No 2 | | |
| **PRACTICAL NO.03** | **LINKED LIST** | **8 HOURS** |
| Design and develop program for insertion, updating, searching, sorting, listing and deletion operations using singly linked list for any one of the following applications :-<br>1. Placement Information System<br>2. Railway Reservation System<br>3. Billing System at Mall<br>**Self-Study:-** Practice Problem No 3 | | |
| **PRACTICAL NO.04** | **DOUBLY LINKED LIST** | **4 HOURS** |
| Design and implement a program for sorting two given lists and merging these two sorted lists of marks scored for technical skill examination of recruitment cell using doubly linked list.<br>**Self-Study:-** Practice Problem No 4 | | |
| **PRACTICAL NO.05** | **CIRCULAR LINKED LIST** | **4 HOURS** |
| Pizza parlor accepting maximum M orders. Orders are served in first come first served basis. Order once placed cannot be cancelled. Write a program to simulate the system using circular linked list.<br>**Self-Study:-** Practice Problem No 5 | | |

| PRACTICAL NO.06 | STACK | 4 HOURS |
|---|---|---|

Given as input a prefix expression. Implement a program for following conversions :-
a) prefix to infix
b) Infix to postfix,
c) postfix evaluation
**Self-Study:-** Practice Problem No 6

| PRACTICAL NO.07 | RECURSION | 2 HOURS |
|---|---|---|

Design and implement a program for 2 * 2 Suduko Solver using Recursive Backtracking
**Self-Study:-** Practice Problem No 7

| PRACTICAL NO.08 | CIRCULAR QUEUE | 6 HOURS |
|---|---|---|

Implement Round Robin CPU Scheduling using circular queue for the following :-

| Process | P1 | P2 | P3 | P4 | P5 |
|---|---|---|---|---|---|
| Arrival Time | 0 | 1 | 2 | 3 | 4 |
| Burst Time | 5 | 3 | 1 | 2 | 3 |

**Self-Study:-** Practice Problem No 8 and 9

| PRACTICAL NO.09 | DOUBLY ENDED QUEUE | 6 HOURS |
|---|---|---|

Design and implement a program for double ended queue and its operations for a shopping mall under given Scenarios :-
a) Input Restricted Deque
b) Output Restricted Deque.
**Self-Study:-** Practice Problem No 10

| PRACTICAL NO.10 | SEARCHING AND SORTING | 12 HOUR |
|---|---|---|

Consider a student database of TY BTECH class (at least 15 records). Database contains different fields of every student like Roll No, Name, SGPA and Department. Perform the following operations:-
a) Design a roll call list, arrange list of students according to roll numbers in ascending order (Use Bubble Sort).
b) Arrange list of students alphabetically. (Use Insertion sort).
c) Arrange list of students to find out first ten toppers from a class. (Use Quick sort).
d) Search students according to SGPA. If more than one student having same SGPA, then print list of all students having same SGPA. (Use Linear Search).
e) Search a particular student according to name using binary search without recursion. (all the student records having the presence of search key should be displayed) (Use Binary Search).
f) Search whether a particular student belongs to computer department or not.(Use Fiibonacci Search).
**Self-Study:-** Practice Problem No 11 and 12

| PRACTICAL NO.11 | HASHING | 6 HOURS |
|---|---|---|

a) Raman has a cold drink corner shop in he wants to store information about different flavours of cold drink available in a table using hash function hash (key) = key mod 6 where key is the data to be inserted into the Hash table. Write a C++ program to implement hash table for collision handling using linear probing without chaining without replacement.

b) Marks out of 100 of 20 students needs to be stored in a table using hash function hash (key) = key mod 20 where key is the data to be inserted into the Hash table. Write a C++ program to implement hash table for collision handling using separate chaining without replacement using linked list for the following data :- 33,56,78,12,10,67,89,99,100,23,45,71,39,62,59,90,91,20,75,66.

c) Lalit has a fresh mango fruit shop and he wants to store information about 11 varieties of mangoes available in a table using hash function hash (key) = key mod 11 where key is the number of mangoes of each category . write a C++ program to implement hash table for collision handling using quadratic probing without replacement for the following data.

| Category | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No of Mangoes | 25 | 15 | 10 | 5 | 11 | 19 | 16 | 36 | 42 | 28 | 32 |

**Self-Study:-** Practice Problem No 13 and 14

**PRACTICE PROBLEMS:**

1. Implement a program for left rotation and right rotation of array by a given number k.
2. Implement a program for addition and multiplication of two matrices using concepts of 2-D arrays.
3. Implement a program for addition of two polynomials using concepts of linked list.
4. Implement a program for merging a doubly linked list into another doubly linked list at alternate positions and sorting the resultant doubly linked list.
5. Implement railway reservation system using a circular linked list.
6. Implement 8 Queens problem using stack.
7. Implement Tower of Hanoi problem using concept of recursion.
8. Implement basic operations of priority queue for managing the appointments of patients at a hospital.
9. Implement FCFS and SJF scheduling in non-preemptive mode using suitable queue.
10. Implement a program to check whether the given string is palindrome or not using doubly ended queue.
11. Implement a program to store names and mobile numbers of your friends in sorted order on names. Search your friend from list using Sentinel search. Insert friend if not present in phone book.
12. Implement a program to store percentage of second year students in array. Write a function for sorting array of floating point numbers in ascending order using Merge Sort.
13. Scores of batsman in twelve overs needs to be stored in a table using hash function hash (key) = key mod overs where key is the data to be inserted into the Hash table. Write a C++ program to implement hash table for collision handling using separate chaining with replacement using linked list for the following data :- 10, 5,4,14,15,20,1,11,6,16,36,28.
14. Vinay has a medical shop and he wants to store information of medical stock available in a table using hash function hash (key) = key mod 9 where key is the data to be inserted into the Hash table. Write a C++ program to implement hash table for collision handling using linear probing without changing with replacement.

## TEXT BOOKS


1. E. Horowitz S. Sahani, D. Mehta. (2018). *Fundamentals of Data Structures in C++", 10th Edition, Universities Press. ISBN-13: 978-8173716065.*
2. Michael T. Goodrich, Roberto Tamassia, David M. Mount. (2018). *Data Structures and Algorithms in C++*, 5th Edition, John Wiley Sons. ISBN-13: 978-0470383278
3. T. Cormen, C Leiserson, R. Rivest, C Stein. (2016) *Introduction to Algorithms.7th Edition MIT press,2016,ISBN-13: 978-0262533058.*


## REFERENCE BOOKS


1. Richard F. Gilberg, Behrouz A Forouzan. (2016). *Data structures- A pseudocode Approach with C++" 4th Edition, Cengage l earning. ISBN 9780534390808..*
2. E. Horowitzs S. Sahani, S. Rajashekharan. (2015). *Fundametals of Computer Algorithms, Universities Press. ISBN-13: 978-8 173716126*
3. Debasis Samanta.(2012). *Classic Data Structures, 2nd Edition, Tata McGraw Hill. ISBN-13: 978-8120337312.*


## E-R ESOURCES

1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106106127

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | 2024 - 2025 (Rev. ) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Computer Organiztaion and Architecture |
| | **COURSE CODE** | 2304221T |
| | **COURSE CREDITS** | 1 |
| **RELEASED DATE :** | **REVISION NO** | 2.1 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

**PRE-REQUISITE KNOWLEDGE:** Electrical & Electronics Engineering,

**COURSE OBJECTIVES :**

2304221T.CEO.1: To comprehend the architecture and intrsuction set of 80386 Microprocessor.
2304221T.CEO.2: To get familiar with assembly language programming.
2304221T.CEO.3: To learn working of arithmetic unit of the computer system.
2304221T.CEO.4: To get acquainted with the organization of control unit and instruction pipelining of the computer system.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304221T.CO.1: Explicate the architecture and instruction set of the 80386 microprocessor. [L2]
2304221T.CO.2: Develop assembly language programs using 80386 instruction set. [L3]
2304221T.CO.3: Illustrate processor level details about arithmetic operations using computer arithmetic algorithms. [L3]
2304221T.CO.4: Demonstrate the different ways to generate control signals and their organization techniques and instruction pipelining of computer system. [L3]

**COURSE ABSTRACT:**

The Computer Organization and Architecture course is a fundamental exploration of the inner workings of modern computer systems. This course delves into the intricate design and organization of computer hardware, bridging the gap between software development and hardware engineering. Students will gain a comprehensive understanding of the various components that make up a computer system, including central processing units, memory, input/output systems, and the interconnections that facilitate data transfer. By the end of the course, students will possess a solid foundation in computer architecture, enabling them to optimize software for hardware, design efficient systems, and make informed decisions regarding computer system upgrades and configuration. This knowledge is vital for both computer science and electrical engineering students, as well as anyone interested in a deep understanding of how computers work.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Architecture and Instruction Set of 80386 Processor** | **5 HOURS** |

**App/System/Case study:** Pentium and AMD Processors

**Contents:**

Computer Organization and Architecture, Evolution (a brief history) of computers, Evolution of Intel processor architecture- 4 bit to 64 bit, Computer Components, Computer Function, Interconnection structure, 80386 Architecture, Features of 80386, Registers, Global Descriptor Table, Local Descriptor Table, Interrupt Descriptor Table, Data Types, 80386 Instruction Set, 80386 addressing modes, CISC, RISC, Multiprocessor and Multi-Core Computers

**Self-study:** Pentium IV processor architecture

**Further Reading:** Intel core i9 processor architecture

| | | |
|---|---|---|
| **UNIT 2** | **Arithmetic Operations** | **5 HOURS** |

**App/System/Case study:** Binary representation of program

**Contents:** Design of Fast Adders, Addition of positive numbers, Addition and Subtraction of Signed Numbers, Multiplication of Positive Numbers, Signed Operand Multiplication, Floating-point Numbers and Operations.

**Self-study:** Integer division

**Further Reading:** Floating point processor architecture.

| | | |
|---|---|---|
| **UNIT 3** | **Control Unit and Instruction Pipelining** | **5 HOURS** |

**App/System/Case study:** Control Unit in Ultra SPARC II Architecture

**Contents: Control Unit:** Single-Bus Organization, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control Design, Microinstructions, Microprogram Sequencing, Microinstructions with Next-Address Field, Microprogrammed Control Design **Pipelining:** Basic Concepts, Data Hazards, Structural Hazards, Control Hazards, Flynn's Taxanomy

**Self-study:** Superscalar Architecture

**Further Reading:** GPU architecture.

## TEXT BOOK


1. Douglas V. Hall, "Microprocessors and Interfacing Programming and Hardware", 8086.80286.80386.80486, Second Edition, Tata McGraw Hil
2. Intel 80386 Programmer's Reference Manual 1986, Intel Corporation, Order no.: 231630-011, December 1995.
3. Barry B. Brey, "The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium pro Processor, Pentium II, Pentium III, Pentium 4, and Core2 ... - Architecture, Programming, and Interfacing".
4. W. Stallings, "Computer Organization and Architecture: Designing for performance", Pearson Education/ Prentice Hall of India, 2003, ISBN 978-93-325-1870-4, 7th Edition.
5. Zaky S, Hamacher, "Computer Organization", 5th Edition, McGraw-Hill Publications, 2001, ISBN- 978-1-25-900537-5, 5th Edition.


## REFERENCE BOOK


1. M Morris Mano "Digital Logic and Computer Design" 1/e Pearson, June 2016.
2. Kauffmann, Computer System Architecture by M. Mano, 2001, Prentice-Hall ISBN 72157661505664197
3. John P Hays, "Computer Architecture and Organization", McGraw-Hill Publication, 1998, ISBN:9781259028564, 3rd Edition.


## E-R ESOURCES

1. https://nptel.ac.in/courses/106103068

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | 2024 - 2025 (Rev. ) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Computer Organiztaion and Architecture Lab |
| | **COURSE CODE** | 2304221L |
| | **COURSE CREDITS** | 1 |
| **RELEASED DATE :** | **REVISION NO** | 2.1 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 20 | 40 |

**PRE-REQUISITE KNOWLEDGE:** Electrical & Electronics Engineering,

**COURSE OBJECTIVES :**

2304221L.CEO.1: To comprehend the architecture and intrsuction set of 80386 Microprocessor.
2304221L.CEO.2: To get familiar with assembly language programming.
2304221L.CEO.3: To learn working of arithmetic unit of the computer system.
2304221L.CEO.4: To get acquainted with the organization of control unit and instruction pipelining of the computer system.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304221L.CO.1: Explicate the architecture and instruction set of the 80386 microprocessor. [L2]
2304221L.CO.2: Develop assembly language programs using 80386 instruction set. [L3]
2304221L.CO.3: Illustrate processor level details about arithmetic operations using computer arithmetic algorithms. [L3]
2304221L.CO.4: Demonstrate the different ways to generate control signals and their organization techniques and instruction pipelining of computer system. [L3]

**COURSE ABSTRACT:**

The Computer Organization and Architecture course is a fundamental exploration of the inner workings of modern computer systems. This course delves into the intricate design and organization of computer hardware, bridging the gap between software development and hardware engineering. Students will gain a comprehensive understanding of the various components that make up a computer system, including central processing units, memory, input/output systems, and the interconnections that facilitate data transfer. By the end of the course, students will possess a solid foundation in computer architecture, enabling them to optimize software for hardware, design efficient systems, and make informed decisions regarding computer system upgrades and configuration. This knowledge is vital for both computer science and electrical engineering students, as well as anyone interested in a deep understanding of how computers work.

| **PRACTICAL:** | | |
|---|---|---|
| **PRACTICAL NO.1** | | **4 HOURS** |
| Design your ALU using CPU simulator for arithmetic operations. | | |
| **PRACTICAL NO.2** | | **4 HOURS** |
| Design your Control Unit using CPU simulator for arithmetic operations. | | |
| **PRACTICAL NO.3** | | **4 HOURS** |
| Write an ALP to accept the 64 bit numbers from user, perform arithmetic operations on them, and display the result. | | |
| **PRACTICAL NO.4** | | **6 HOURS** |
| Write an ALP to convert 64 bit Hex number into its equivalent BCD number and 64 bit BCD number into its equivalent HEX number. | | |
| **PRACTICAL NO.5** | | **4 HOURS** |
| Write an ALP to perform multiplication of two 64-bit hexadecimal numbers using successive addition and add and shift method. | | |
| **PRACTICAL NO.6** | | **4 HOURS** |
| Write an ALP to implement various string operations. | | |
| **PRACTICAL NO.7** | | **4 HOURS** |
| Write an ALP to find the roots of the quadratic equation for all the possible cases. | | |

## TEXT BOOK


1. Douglas V. Hall, "Microprocessors and Interfacing Programming and Hardware", 8086.80286.80386.80486, Second Edition, Tata McGraw Hil
2. Intel 80386 Programmer's Reference Manual 1986, Intel Corporation, Order no.: 231630-011, December 1995.
3. Barry B. Brey, "The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium pro Processor, Pentium II, Pentium III, Pentium 4, and Core2 ... - Architecture, Programming, and Interfacing".
4. W. Stallings, "Computer Organization and Architecture: Designing for performance", Pearson Education/ Prentice Hall of India, 2003, ISBN 978-93-325-1870-4, 7th Edition.
5. Zaky S, Hamacher, "Computer Organization", 5th Edition, McGraw-Hill Publications, 2001, ISBN- 978-1-25-900537-5, 5th Edition.


## REFERENCE BOOK


1. M Morris Mano "Digital Logic and Computer Design" 1/e Pearson, June 2016.
2. Kauffmann, Computer System Architecture by M. Mano, 2001, Prentice-Hall ISBN 72157661505664197
3. John P Hays, "Computer Architecture and Organization", McGraw-Hill Publication, 1998, ISBN:9781259028564, 3rd Edition.


## E-R ESOURCES

1. https://nptel.ac.in/courses/106103068

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2024 - 2025 (Rev. ) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | COMPUTER GRAPHICS |
| | **COURSE CODE** | 2304218T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 2.1 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** Mathematics, Foundation of Computing.

## COURSE OBJECTIVES :

2304218T.CEO.1: To explain the basic concepts of computer graphics.
2304218T.CEO.2: To make familiar with mathematics behind graphical representation with the multimedia systems.
2304218T.CEO.3: To emphasize on implementation aspect of Computer Graphics Algorithms
2304218T.CEO.4: To get acquainted with different methods of projections and viewing
2304218T.CEO.5: To describe various methods of clipping.
2304218T.CEO.6: To provide the basic knowledge of light, color and texture mapping

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2304218T.CO.1: Apply OpenGL graphics primitives to develop graphics applications. [L3].
2304218T.CO.2: Solve the real time problems using geometric transformations. [L3]
2304218T.CO.3: Develop 2D and 3D objects using various algorithms. [L3]
2304218T.CO.4: Apply various methods for projection and viewing it into real world.[L3]
2304218T.CO.5: Implement the suitable clipping algorithms. [L3]
2304218T.CO.6: Design the texture images, light and color using different objects. [L3]

**COURSE ABSTRACT:**

Computer Graphics is one of the fundamental aspects of any computing system. Computer Graphics can be used in UI design, rendering, geometric objects, animation. This course offers exploration of Computer Graphics fundamentals, present day graphics hardware (I/O devices, GPU) and the widely popular openGL graphics library with programming basics, different types of GUI, multimedia architecture, recent technologies in multimedia, Computer Graphics core algorithms for drawing geometric shapes like line, circle, polygon, basic of 2D and 3D transformations, matrices, window and viewport concept, different line and polygon clipping algorithm, various color models with texture mapping. The goal of Computer Graphics study is to impart the knowledge of technology, procedures, and develop skills in computer graphics with multimedia.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **REAL WORLD INTERACTION** | **05 HOURS** |

**Applications/Case Study:** Games, Animation

**Contents:** OpenGL as a State Machine, Display Points, Lines, and Polygons in OpenGL, OpenGL Geometric Drawing Primitives, Normal Vectors, Vertex Arrays, OpenGL Rendering Pipeline, OpenGL-Related Libraries Basics of GLUT. Animations: Introduction, Animation Languages,Rendering pipeline. .

**Self Study:** Gaming,Introduction to GPU, Gaming platform (NVIDIA CUDA, i8060), Advances in Gaming

**Further Readings:** Simulations,Physics-based and procedural animations.

| | | |
|---|---|---|
| **UNIT 2** | **GRAPHICAL USER INTERFACES AND MULTIMEDIA** | **05 HOURS** |

**Applications/Case Study:** Display devices- OLEDs, Micro LEDs, Radar displays

**Contents:** Introduction, Pixel, Frame buffer, Resolution, Aspect ratio, Raster scan and Random scan display, Primitives: Lines, Line segments, Vector, Vectors Display file Structure, display file Interpreter, Character generating methods, Alising and Antialiasing techniques.

**Self Study:**CRT basics, Flat panel displays, Plasma Panel

**Further Readings:**hypermedia.

| | | |
|---|---|---|
| **UNIT 3** | **SCAN CONVERSION** | **05 HOURS** |

**Applications/Case Study:** Design of different 2D objects and 3D objects

**Contents:** Line Drawing algorithms: DDA, Bresenham, Circle drawing algorithms: Bresenham, Mid-point Filled Area Primitive: Polygon, Types of Polygons, Inside and outside tests, Scan line polygon Fill Algorithm, Boundary Fill and Flood Fill Algorithm

**Self Study:** Line styles: Thin, Thick, Dotted, Self-Intersecting polygon.

**Further Readings:**DDA Circle drawing algorithm, Different Polygon filling algorithms.

| UNIT 4 | 2D AND 3D GEOMETRIC TRANSFORMATION | 05 HOURS |
|---|---|---|

**Applications/Case Study:** Animation, Augmented Reality

**Contents:** 2D Transformations: Introduction, Matrices, Translation, Scaling, Rotation, Homogeneous coordinates and matrix representation, rotation about an origin, rotation about an arbitrary point, Inverse transformation, Shear transformation, Reflection

3D Transformations: Introduction, Matrices, Rotation about an arbitrary axis,s

**Self Study:** Classification of Projection,Parallel and Perspective projection

**Further Readings:**Composite Transformation

| UNIT 5 | WINDOWING,CLIPPING AND CURVES | 05 HOURS |
|---|---|---|

**Applications/Case Study:** Image Segmentation, 2D viewing

**Contents:** Windowing: Introduction, Viewport, viewing transformation, Clipping: 2D clipping,line clipping algorithm,Polygon clipping Algorithms.

Curve: Introduction to curve generation, Interpolation, B-Splines, Bezier curve, Blending function

**Self Study:** Irregular curves: Joints and Knots

**Further Readings:**3D Viewing, 3D Clipping, Cyrus – Beck Clipping, Triadic curve, Fractals.

| UNIT 6 | LIGHT, COLOR MODELS AND TEXTURE MAPPING | 05 HOURS |
|---|---|---|

**Applications/Case Study:** graphical 3-D model effects

**Contents:** Light: Introduction, Diffused illumination, point source illumination

Texture-Mapping: Process, steps of Texture Mapping, Specifying the Texture.

**Self Study:** Shading algorithms

Color models: RGB, HSV, CMY

**Further Readings:** Hidden Surface and back face removal algorithms.

## TEXT BOOKS


1. Steve Marschner,Peter Shirley (2021). *Fundamentals of Computer Graphics*. 7th Edition, CRC press . ISBN 9781032122861.
2. D. Hearn and M. Baker (2002). *Computer Graphics*. 2nd Edition, Pearson Education. ISBN 7808- 7944.
3. D. Rogers (2001). *Procedural Elements for Computer Graphics*. 2nd Edition, Tata McGraw-Hill publication. ISBN 0-07-047371-4.
4. S. Harrington (1987). *Computer Graphics*. 2nd Edition, McGraw-Hill publication. ISBN 0-07-100472-6.
5. D.Rogers, J.Adams(2002). *Mathematical Elements for Computer Graphics*. 2nd Edition, Tata McGraw-Hill publication, ISBN 0-07-048677-8.
6. Foley, van Dam, Feiner, Hughes, and Phillips(1994). *Introduction to Computer Graphics*. 2nd Edition, ISBN 978-0-201-60921-9
7. Yoshinori Dobashi , Shizuo Kaji Kei Iwasaki(2019). *Mathematical Insights into Advanced Computer Graphics Techniques* . 1st Edition,
8. Edward Angel(2012). *Interactive Computer Graphics: A Top-Down Approach Using OpenGL* . 6th Edition,Addison-Wesley .


## REFERENCE BOOKS


1. James D.Foley,Andries Van Dam (2018). *Fundamentals of Interactive Computer Graphics*. 13th Edition, AddisonWesley.
2. M. Woo, J. Neider, T. Davis, D. Shreiner *2. OpenGL Programming Guide: The Official Guide to Learning OpenGL*. 3rd Edition, Addison-Wesley.
3. *OpenGL Reference Manual*. rd , OpenGL Architecture Review Board
4. Steve Marschner, Peter Shirley *Fundamentals of Computer Graphics*. 4th Edition, o'reilly.


## E-R ESOURCES

1. https://nptel.ac.in/courses/106102063
2. https://nptel.ac.in/courses/106106090

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2024 - 2025 (Rev. ) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | COMPUTER GRAPHICS LAB |
| | **COURSE CODE** | 2304218L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | 2.1 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Mathematics, Foundation of Computing.

**COURSE OBJECTIVES :**

2304218L.CEO.1: To explain the basic concepts of computer graphics.
2304218L.CEO.2: To make familiar with mathematics behind graphical representation with the multi-media systems.
2304218L.CEO.3: To emphasize on implementation aspect of Computer Graphics Algorithms
2304218L.CEO.4: To get acquainted with different methods of projections and viewing
2304218L.CEO.5: To describe various methods of clipping.
2304218L.CEO.6: To provide the basic knowledge of light, color and texture mapping

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304218L.CO.1: Apply OpenGL graphics primitives to develop graphics applications. [L3].
2304218L.CO.2: Solve the real time problems using geometric transformations. [L3]
2304218L.CO.3: Develop 2D and 3D objects using various algorithms. [L3]
2304218L.CO.4: Apply various methods for projection and viewing it into real world.[L3]
2304218L.CO.5: Implement the suitable clipping algorithms. [L3]
2304218L.CO.6: Design the texture images, light and color using different objects. [L3]

**COURSE ABSTRACT:**

Computer Graphics is one of the fundamental aspects of any computing system. Computer Graphics can be used in UI design, rendering, geometric objects, animation. This course offers exploration of Computer Graphics fundamentals, present day graphics hardware (I/O devices, GPU) and the widely popular openGL graphics library with programming basics, different types of GUI, multimedia architecture, recent technologies in multimedia, Computer Graphics core algorithms for drawing geometric shapes like line, circle, polygon, basic of 2D and 3D transformations, matrices, window and viewport concept, different line and polygon clipping algorithm, various color models with texture mapping. The goal of Computer Graphics study is to impart the knowledge of technology, procedures, and develop skills in computer graphics with multimedia.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Develop a program to draw a triangle using OpenGL.** | **2 HOURS** |
| Further practice: Develop a program to draw other geometric objects and shade it with different colors. | | |
| **PRACTICAL NO.02** | **Implement Bresenham's Line and circle drawing algorithm.** | **2 HOURS** |
| Further practice: Implement DDA Line and circle algorithm/ Draw a moving cycle. | | |
| **PRACTICAL NO.03** | **Develop a program to ftll the polygon using scan line algorithm.** | **2 HOURS** |
| Further practice: Develop a program to fill the polygon using seed fill, flood fill, boundary fill algorithms. | | |
| **PRACTICAL NO.04** | **Draw a color cube and spin it using OpenGL transformation matrices.** | **2 HOURS** |
| Further practice: Create and rotate a triangle about the origin and a fixed point. | | |
| **PRACTICAL NO.05** | **Develop a program to clip a line using Cohen-Sutherland algorithm.** | **2 HOURS** |
| Further practice: Develop a program to animate a flag using Bezier Curve algorithm. | | |
| **PRACTICAL NO.06** | **Develop a program to create texture like checkerboard using texture mapping.** | **2 HOURS** |
| Further practice: Develop a program to create texture cube. | | |
| **MINI PROJECTS** | | **18 HOURS** |
| Design and implement game / animation clip / Graphics Editor using open-source graphics library and computer graphics concepts with multimedia. | | |

## TEXT BOOKS


1. Steve Marschner,Peter Shirley (2021). *Fundamentals of Computer Graphics*. 7th Edition, CRC press . ISBN 9781032122861.
2. D. Hearn and M. Baker (2002). *Computer Graphics*. 2nd Edition, Pearson Education. ISBN 7808- 7944.
3. D. Rogers (2001). *Procedural Elements for Computer Graphics*. 2nd Edition, Tata McGraw-Hill publication. ISBN 0-07-047371-4.
4. S. Harrington (1987). *Computer Graphics*. 2nd Edition, McGraw-Hill publication. ISBN 0-07-100472-6.
5. D.Rogers, J.Adams(2002). *Mathematical Elements for Computer Graphics*. 2nd Edition, Tata McGraw-Hill publication, ISBN 0-07-048677-8.
6. Foley, van Dam, Feiner, Hughes, and Phillips(1994). *Introduction to Computer Graphics*. 2nd Edition, ISBN 978-0-201-60921-9
7. Yoshinori Dobashi , Shizuo Kaji Kei Iwasaki(2019). *Mathematical Insights into Advanced Computer Graphics Techniques* . 1st Edition,
8. Edward Angel(2012). *Interactive Computer Graphics: A Top-Down Approach Using OpenGL* . 6th Edition,Addison-Wesley .


## REFERENCE BOOKS


1. James D.Foley,Andries Van Dam (2018). *Fundamentals of Interactive Computer Graphics*. 13th Edition, AddisonWesley.
2. M. Woo, J. Neider, T. Davis, D. Shreiner *2. OpenGL Programming Guide: The Official Guide to Learning OpenGL*. 3rd Edition, Addison-Wesley.
3. *OpenGL Reference Manual*. rd , OpenGL Architecture Review Board
4. Steve Marschner, Peter Shirley *Fundamentals of Computer Graphics*. 4th Edition, o'reilly.


## E-R ESOURCES

1. https://nptel.ac.in/courses/106102063
2. https://nptel.ac.in/courses/106106090

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F. | AY: 2024 - 2025 (Rev. (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Problem Solving Using Object Oriented Programming (C++) |
| | COURSE CODE | 2304261L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : 01/07/ | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** BASIC COMPUTING KNOWLEDGE

**COURSE OBJECTIVES :**

2304261L.CEO.1: To demonstrate Object Oriented Programming concepts.
2304261L.CEO.2: To illustrate modularity, scalability and code reusability.
2304261L.CEO.3: To identify various perspectives of a problem.
2304261L.CEO.4: To choose the optimal solution for real life problems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304261L.CO.1: Develop solutions for real world problems using Object Oriented Programming. [L3]
2304261L.CO.2: Choose an appropriate programming solution to reduce complexity. [L3]
2304261L.CO.3: Apply critical thinking and programming skills for problem solving. [L3]
2304261L.CO.4: Utilize logic building traits efficiently for solving real life problems. [L3]

**COURSE ABSTRACT:**

Problem Solving using Object Oriented Programming (C++) is the Skill Development Course. The basic aim of the course is to introduce the students to Object Oriented Programming using C++ and make their concepts clear for designing real time applications using the same. The inclusion of Challenging Problems in the course will enhance students' logical thinking and boost their analytical skills. Various stages in problem solving will help students to deal with complex problems easily. This course will improve students problem solving abilities and coding skills.

**CONTENTS :**

Introduction to C++, Tokens, Data types, Operators, Structure of C++ Programs, Classes and Objects, Constructors, Destructors; Arrays, Expressions and Control Structures, Types of Constructors and Member Functions; Overloading; Reference and Pointers, Dynamic Memory Management; Functions in C++: Argument passing in function, Inline Functions, Default Arguments, Constant Arguments, Friend class, Friend function; Inheritance; Polymorphism; Exception Handling; std::move in utility; Templates; Standard Template Library; Type casting and cast operators.

**Self Study:** Structures, Union

**Further Readings:** File Handling Operations, Multithreading

| **OBJECT ORIENTED PROGRAMMING:** | | |
|---|---|---|
| **PRACTICAL: All assignments should be performed considering real world applications.** | | |
| **PRACTICAL NO.01** | **CLASS AND OBJECTS** | **2 HOURS** |
| Write a program on class, constructor, destructor, and user-defined functions. | | |
| **PRACTICAL NO.02** | **CONSTRUCTOR TYPES** | **2 HOURS** |
| Implement various types of constructors and member functions. | | |
| **PRACTICAL NO.03** | **OPERATOR OVERLOADING** | **2 HOURS** |
| Write a program on operator overloading using default and parameterized constructors. | | |
| **PRACTICAL NO.04** | **DYNAMIC MEMORY** | **4 HOURS** |
| a) Assignment based on references and pointers.<br>b) Write a program on new and delete operators in C++ for dynamic memory. | | |
| **PRACTICAL NO.05** | **FUNCTION TYPES, FRIEND CLASS** | **4 HOURS** |
| Assignment based on class, objects, this pointer, inline function, static member function and friend class. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.06** | **INHERITANCE** | **2 HOURS** |
| Implement different types of inheritance. | | |
| **PRACTICAL NO.07** | **POLYMORPHISM** | **2 HOURS** |
| Write a program on polymorphism. | | |
| **PRACTICAL NO.08** | **EXCEPTION HANDLING** | **2 HOURS** |
| Implement exception handling operations. | | |
| **PRACTICAL NO.09** | **STD::MOVE IN UTILITY** | **2 HOURS** |
| Write a program on std::move in utility. | | |
| **PRACTICAL NO.10** | **TEMPLATES** | **2 HOURS** |
| Implement class template, function template. | | |
| **PRACTICAL NO.11** | **STANDARD TEMPLATE LIBRARY** | **4 HOURS** |
| a) Assignment based on list class as a container of standard template library.<br>b) Assignment based on vector class as a container of standard template library. | | |
| **PRACTICAL NO.12** | **TYPE CASTING** | **2 HOURS** |
| Assignment based on type casting and casting operators. | | |

| PROBLEM SOLVING: | | |
|---|---|---|
| **01** | **BASIC PROGRAMMING** | **2 HOURS** |
| **02** | **NUMBER SYSTEM** | **2 HOURS** |
| **03** | **ARRAY** | **2 HOURS** |
| **04** | **MATRIX** | **2 HOURS** |
| **05** | **STRING** | **2 HOURS** |
| **06** | **MATH** | **2 HOURS** |
| **07** | **BIT MANIPULATION** | **2 HOURS** |
| **08** | **SEARCHING AND SORTING** | **2 HOURS** |
| **09** | **INHERITANCE** | **2 HOURS** |
| **10** | **POLYMORPHISM** | **2 HOURS** |
| **11** | **TEMPLATES/COLLECTION** | **2 HOURS** |
| **12** | **MULTITHREADING** | **4 HOURS** |
| **13** | **STACK AND QUEUE (FURTHER PRACTICE)** | **2 HOURS** |
| **14** | **FILE PROCESSING (FURTHER PRACTICE)** | **2 HOURS** |

## EXAMINATION SCHEME

1. Continuous Assessment: 20 Marks
2. Mid Semester Practical Examination for Problem Solving: 15 Marks
3. End Semester Practical Examination for OOP(C++): 20 Marks
4. End Semester Practical Examination for Problem Solving: 20 Marks

## TEXT BOOKS


1. E. Balgurusawmy. (2020). *Object Oriented Programming with C++*. 8th Edition, McGraw Hill Publishers. ISBN 9389949181.
2. Paul Deitel, Harvey Deitel. (2017). *C++: How to Program*. 10th Edition, Pearson International. ISBN 9789332585737.
3. Sprankle Maureen. (2011). *Problem Solving and Programming Concepts*. 9th Edition, Person. ISBN 978-0132492645.
4. Savitch Walter. (2017). *Problem Solving with C++*. 10th Edition, Person. ISBN 978-0134448282.

## REFERENCE BOOKS


1. Bjarne Stroustroup. (2014). *Programming - Principles and Practice using C++*. 2nd Edition, Addison-Wesley Educational Publishers Inc . ISBN 978-0275967819.
2. Herbtz Schildt. (2017). *C++: The Complete reference*. 4th Edition, McGraw Hill Education. ISBN 978-0070532465.
3. V. Anton Spraul. (2012). *Think Like a Programmer: An Introduction to Creative Problem Solving*. 1st Edition, No Starch Press US. ISBN 978-1593274245.


## E-RESOURCES

1. https://nptel.ac.in/courses/106105151
2. https://nptel.ac.in/courses/106101208

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2024 - 2025 (Rev. (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Problem Solving Using Object Oriented Programming (JAVA) |
| | COURSE CODE | 2304262L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : 01/07/ | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** FUNDAMENTALS OF COMPUTING

**COURSE OBJECTIVES :**

2304262L.CEO.1: To demonstrate Object Oriented Programming concepts.
2304262L.CEO.2: To illustrate modularity, scalability and code reusability.
2304262L.CEO.3: To identify various perspectives of a problem.
2304262L.CEO.4: To choose the optimal solution for real life problems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304262L.CO.1: Develop solutions for real-world problems using Object Oriented Programming. [L3]
2304262L.CO.2: Choose an appropriate programming solution to reduce complexity. [L5]
2304262L.CO.3: Apply critical thinking and programming skills for problem solving. [L3]
2304262L.CO.4: Utilize logic building traits efficiently for solving real life problems. [L3]

**COURSE ABSTRACT:**

Problem Solving using Object Oriented Programming (JAVA) is the Skill Development Course. The basic aim of the course is to introduce the students to Object Oriented Programming using JAVA. and make their concepts clear for designing real time applications using the same. The inclusion of Challenging Problems in the course will enhance students' logical thinking and boost their analytical skills. Various stages in problem solving will help students to deal with complex problems easily. This course will improve students problem solving abilities and coding skills.

**CONTENTS :**

Basics of Java, Data Types and Variables, Operators, Control Statements,Looping, Arrays; String, String Buffer, String Builder; Methods, Lambda Expression, Constructor; Object Oriented Programming System : Classes and Objects, Modifiers, Inner Classes; Inheritance; Super,This,Static and Final Keywords; Polymorphism: Method Overloading, Method Overriding; Abstraction, Interfaces; Exception Handling, Create Own Exceptions; Multithreading ; Packages, Collections Framework; File Handling; Generics; Introduction to Swing: Layout Management , Swing Components ,Text Fields , Text Areas ,Buttons, Check Boxes, Radio Buttons , Lists, Choices, Scrollbars , Windows ,Menus , Dialog Boxes;

**Self Study:** Bytecode in Java ,Bytecode vs Machine code, JRE, Java API,JVM in Java,JVM Architecture, Class Loader,Interpreter in Java Interpreter vs Compiler,Download Install Java Development Kit JDK,Download Eclipse IDE for Java Developers

| **OBJECT ORIENTED PROGRAMMING USING JAVA:** | | |
|---|---|---|
| **PRACTICAL: All assignments should be performed considering real world applications.** | | |
| **PRACTICAL NO.01** | **FUNDAMENTALS OF JAVA** | **4 HOURS** |
| a) Write a program based on the basics of Java<br>b) Implement a program using Control Statement, Looping, Array | | |
| **PRACTICAL NO.02** | **STRING, STRING BUFFER, STRING BUILDER** | **2 HOURS** |
| a) Program for implementing string operations | | |
| **PRACTICAL NO.03** | **CLASS-OBJECT, METHODS, CONSTRUCTORS AND LAMBDA EXPRESSION** | **4 HOURS** |
| a) Write a program to create Class, declare Member Variables, Define Methods<br>b) Program to define Constructor, Passing Information to a Method or a Constructor.<br>c) Program to define lambda expression | | |
| **PRACTICAL NO.04** | **JAVA INHERITANCE** | **2 HOURS** |
| a) Program to implement all types of Inheritance | | |

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **STATIC, FINAL , SUPER AND THIS KEYWORD** | **2 HOURS** |
| a) Program to implement static, final , super and this keyword in java | | |
| **PRACTICAL NO.06** | **POLYMORPHISM** | **2 HOURS** |
| a) Program to implement polymorphism | | |
| **PRACTICAL NO.07** | **JAVA ABSTRACT CLASS AND INTERFACES** | **2 HOURS** |
| a) Write a program based on Abstract Class<br>b) Write a program based on Interfaces | | |
| **PRACTICAL NO.08** | **EXCEPTION HANDLING** | **2 HOURS** |
| a) Implement a program to handle different exceptions<br>b) Implement a program to create own exception class | | |
| **PRACTICAL NO.09** | **JAVA SWING** | **4 HOURS** |
| a) Write a program for multi threading<br>b) Write a program to create Frame and make use of Layout Management, User Interface Components | | |
| **PRACTICAL NO.10** | **PACKAGES AND COLLECTIONS** | **2 HOURS** |
| a) Implement a program to create own package<br>b) Implement a program based on Java collections | | |
| **PRACTICAL NO.11** | **FILE HANDLING** | **2 HOURS** |
| a) Write a program for file handling operations | | |
| **PRACTICAL NO.12** | **JAVA GENERICS** | **2 HOURS** |
| a) Implement various generic functions and generic class | | |

| PROBLEM SOLVING USING JAVA: | | |
|---|---|---|
| **01** | **BASIC PROGRAMMING** | **2 HOURS** |
| **02** | **NUMBER SYSTEM** | **2 HOURS** |
| **03** | **ARRAY** | **2 HOURS** |
| **04** | **MATRIX** | **2 HOURS** |
| **05** | **STRING** | **2 HOURS** |
| **06** | **MATH** | **2 HOURS** |
| **07** | **BIT MANIPULATION** | **2 HOURS** |
| **08** | **SEARCHING AND SORTING** | **2 HOURS** |
| **09** | **INHERITANCE** | **2 HOURS** |
| **10** | **POLYMORPHISM** | **2 HOURS** |
| **11** | **COLLECTION** | **2 HOURS** |
| **12** | **MULTITHREADING** | **4 HOURS** |
| **13** | **STACK AND QUEUE (FURTHER PRACTICE)** | **2 HOURS** |
| **14** | **FILE PROCESSING (FURTHER PRACTICE)** | **2 HOURS** |

**EXAMINATION SCHEME**

1. Continuous Assessment: 20 Marks
2. Mid Semester Practical Examination for Problem Solving: 15 Marks
3. End Semester Practical Examination for OOP(Java): 20 Marks
4. End Semester Practical Examination for Problem Solving: 20 Marks

## TEXT BOOKS


1. Herbert Schildt.(2021). "Java The complete reference", 12th Edition, McGraw Hill Education.
2. Cay S. Horstmann, Gary cornell.(2021). "Core Java Volume –I Fundamentals", 12th Edition, Prentice Hall.


## REFERENCE BOOKS


1. K. Arnold and J. Gosling. (2005)."The JAVA programming language", Fourth edition, Pearson Education.
2. Timothy Budd. (2000). "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education.
3. C. Thomas Wu. (2006). "An introduction to Object-oriented programming with Java", Fourth Edition, Tata McGraw-Hill Publishing company Ltd.


## E-R ESOURCES

1. https://nptel.ac.in/courses/106105191

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCE** | **W.E.F** | **AY:** 2024 - 2025 (Rev. (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | UNIVERSAL HUMAN VALUES-II |
| | **COURSE CODE** | 2301287 |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | 4 | NIL | NIL | 25 | NIL | 75 | 100 |

**COURSE OBJECTIVES :**

2301287.CEO.1: To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

2301287.CEO.2: To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

2301287.CEO.3: To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

2301287.CEO.4: To enhance students confidence by strengthening their Professional Skills and Leadership quality. Thus, this course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

2301287.CEO.5: To develop essential soft skills such as leadership, creative writing, and effective communication through practical activities that encourage collaboration and selfawareness.

2301287.CEO.6: To enhance critical thinking and ethical decision-making skills via scenario-based role plays and group discussions, preparing students for real-world challenges.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301287.CO.1: Evaluate the significance of value inputs in formal education and start applying them in their life and profession [L4].

2301287.CO.2: Analyze the value of harmonious relationship based on trust and respect in their life and profession [L3].

2301287.CO.3: Examine the role of a human being in ensuring harmony in society and nature [L3].

2301287.CO.4: Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession [L4].

2301287.CO.5: Demonstrate improved leadership and communication skills by effectively collaborating and articulating ideas in team settings [L3].

2301287.CO.6: Apply critical thinking and ethical considerations in decision-making, showcasing enhanced time management and problem-solving abilities [L4].

**COURSE ABSTRACT**

Every human being has two sets of questions to answer for his/her life: a) what to do? and b) how to do? The first set pertains to the value domain, and the other to the skill domain. Both are complimentary, but value domain has a higher priority. Today, education has become more and more skill biased, and hence, the basic aspiration of a human being, that is to live with happiness and prosperity, gets defeated, in spite of abundant technological progress. This course helps students develop the right understanding and feelings for ethical living. It covers self-exploration, distinguishing between self and Body, building healthy relationships, understanding societal goals, and promoting mutual fulfilment with nature. These insights prepare students to lead ethical lives and professions. Basically, lab is a class that puts together theory and practice on some important soft skills in a dynamic environment. Students shall develop leadership, critical thinking, time management, presentation skills, decisionmaking, emotional intelligence, among others, through very interactive sessions and exercises. This lab will help students succeed in their profession with ethical conduct and collaboration.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction-Basic Human Aspiration, its fulftllment through All-encompassing Resolution** | **3 HOURS** |

**Contents:** The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.

**Self Study:** Exploration of self aspirations and their fulfillment.

| UNIT 2 | Right Understanding (Knowing) - Knower, Known & the Process | 3 HOURS |
|---|---|---|
| **Contents:** The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence its inter-connectedness and co-existence; and finally understanding the role of human being in existence (human conduct).<br>**Self Study:** SWOC Analysis. | | |
| **UNIT 3** | **Understanding Human Being** | **3 HOURS** |
| **Contents:** Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self<br>**Self Study:**Exploration of the relationship between self and other. | | |
| **UNIT 4** | **Understanding Nature and Existence** | **3 HOURS** |
| **Contents:** A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self- awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).<br>**Self Study:** Exploration of the relationship between self and Nature. | | |
| **UNIT 5** | **Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living** | **3 HOURS** |
| **Contents:** Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All- encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence.<br>**Self Study:** Exploration of the relationship between self and Universe. | | |

| **PRACTICALS**: PART A (30 Marks) | | |
|---|---|---|
| **PRACTICAL NO.01** | **Skill development: Leadership Skills** | **4 HOURS** |
| Activities: Group Discussion- 1. Self and Resolution 2. Values and Skills. | | |
| **PRACTICAL NO.02** | **Skill development: Creative Writing Skill** | **4 HOURS** |
| Activities: SWOC analysis, Creative Writing: Assignment (Blog, Essay, Articles etc.). | | |
| **PRACTICAL NO.03** | **Skill development: Time Management** | **4 HOURS** |
| Activities: Debate, Social Project with time management. | | |
| **PRACTICAL NO.04** | **Skill development: Presentation Skills** | **4 HOURS** |
| Activities: Presentation, Picture Description. | | |

| PRACTICAL NO.05 | Skill development: Decision Making, Interpersonal Communication, Emotional intelligence | 4 HOURS |
|---|---|---|
| Activities: Scenario based Decision Making, Role Play- Voice Modulation. | | |
| **PRACTICALS**: PART B (20 Marks) | | |
| **PRACTICAL NO.06** | **Verbal, Reasoning and Aptitude Training** | **24 HOURS** |
| 1. Articles, Tenses, Close Passages<br>2. Vocabulary Test, Verb Agreement, Active/Passive Voice<br>3. Antonyms, Synonyms, Preposition<br>4. Idioms and Phrases, Jumbled Sentences, Reading Comprehension<br>5. Sentence Completion, Sentence Correction, Spotting Error<br>6. Confusing Words, One Word Substitution, Fill in the blanks<br>7. Parts of Speech, Reported Speech, Change of Speech<br>8. Number System<br>9. HCF & LCM , Surds and Indices<br>10. Percentages and Average<br>11. Time and work<br>12. Time, Speed and Distance<br>13. Probability<br>14. Quadratic Equations | | |
| **PRACTICALS**: PART C (24 Marks) | | |
| **PRACTICAL NO.07** | **Final Assessment with Help of Career Assessment Tests** | **15 HOURS** |
| Employability and Aptitude assessment tool. | | |

**TEXT BOOKS**


1. Gaur, R. R., Sangal, R., & Bagaria, G. P. (2010). A Foundation Course in Human Values and Professionals Ethics. Excel Books India.
2. Premvir Kapoor (2022), Professional Ethics and Human Values, Khanna Book Publishing, New Delhi.
3. Tracy, B. (2008). Speak to Win: how to present with power in any situation. Amacom.

**REFERENCE BOOKS/LINKS**


1. A N Tripathy, (2003), Human Values, New Age International Publishers.
2. Meadows, D. H., Meadows, D. H., Randers, J., & Behrens III, W. W. (1972). The limits to growth: a report to the club of Rome (1972). Google Scholar, 91, 2.
3. A Nagraj, (1998), Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
4. Monk, S. (2016). Programming Arduino: getting started with sketches. McGraw-Hill Education.
5. P L Dhar, RR Gaur, (1990), Science and Humanism, Commonwealth Publishers.
6. Subhas Palekar, (2000), How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
7. E G Seebauer& Robert L. Berry, (2000), Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
8. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human
9. B P Banerjee, (2005), Foundations of Ethics and Management, Excel Books.
10. B L Bajpai, ()2004), Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
11. https://www.youtube.com/watch?v=hZSARM4VaVs
12. https://www.youtube.com/watch?v=9-T_zwmnZSc

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: 2024 - 2025 (NEP Rev. ) |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Entrepreneurship Skills |
| | COURSE CODE | 2301276 |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | NEP 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | 2 | Nil | Nil | 25 | 20 | 30 | 75 |

PREREQUISITE: Nil

**COURSE OBJECTIVES :**

2301276.CEO.1: To create awareness regarding entrepreneurship and encourage for selecting entrepreneurship as career option.
2301276.CEO.2: To provide exposure to the philosophies used in startup culture.
2301276.CEO.3: To introduce a basic pathway to become an entrepreneur.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301276.CO.1: Prepare a venture concept by identifying a problem /opportunity through survey [L3].
2301276.CO.2: Devise a value preposition canvas [L4].
2301276.CO.3: Propose a minimum viable product [L5].
2301276.CO.4: Demonstrate the balance sheet estimation for venture [L3].

| COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **Building Entrepreneurial mindset** | **6 HOURS** |
| Skills required for entrepreneurs, Common misconceptions about entrepreneurship, Dealing with Ambiguity, team formation.<br>**Self study**: Technology readiness levels systems. | | |
| **UNIT 2** | **Problem Identiftcation and Opportunity Discovery** | **8 HOURS** |
| Analysis of different aspects of the venture concept, Revisiting the Problem Statement, Calibrate the Problem Statement on the 'Great Problem Litmus Test', composing the Problem Pitch.<br>**Case Study**: Desi Hangover-the shoe story.<br>**Assessment Activity**: Milestone 1 - Create a Value Proposition Canvas tat describes the venture concept and addresses a specific problem/ opportunity [CO1]. | | |
| **UNIT 3** | **Customer and Markets** | **7 HOURS** |
| Market Identification, Customer segmentation, Carving a Niche for identified opportunity, Market sizing, creating a Customer Persona.<br>**Case Study:** Verloop's story on customer acquisition and growth marketing strategies.<br>**Home assignments:**<br>1. Craft your value proposition .<br>2. Create a Value Proposition Canvas.<br>3. Create a sustainable differentiation strategy. | | |
| **UNIT 4** | **Competitive Advantage** | **6 HOURS** |
| Concept of competition, collecting information about the competition, running a competitive analysis, categories of competition, contribution of the competition in the company's success.<br>**Case Study:** How Inzpira personalized communicative English training with a competitive advantage approach.<br>**Assessment Activity**: Milestone 2 - Build the Lean canvas and create MVP version/s Proposing a minimum viable product[CO2, CO3]. | | |
| **UNIT 5** | **Business model and MVP** | **6 HOURS** |
| Business model and the existing types, selection of business model suitable for the venture, Building the Lean canvas, Creating a Minimum Viable Product, Test the MLP.<br>**Case Study:** The Story of Knorish- How did India's Leading Course Creator Platform Build Its MVP.<br>**Home assignments:** Build the Lean canvas and create MVP version/s.<br>**Assessment Activity**: Milestone 3 - Presentation on financial planning and forecasting that estimates the balance sheet of the venture [CO4]. | | |

| UNIT 6 | Financial Feasibility and building brand in the market | 6 HOURS |
|---|---|---|

Financial planning, Components of a financial plan, Building financial plan and projections, Building the Go-To-Market strategy, Building and Positioning the brand, digital marketing plan.

**Case Study:**

1. How Bodh Gems and Crystals managed and tracked their costs to transform their passion into a profit-making business.
2. How Data Sutram piggybacked on the right channels to scale their business Next Generation Entrepreneur.

**Home assignment:** Presentation on financial planning and forecasting.

| UNIT 7 | Managing growth and funding strategy | 6 HOURS |
|---|---|---|

Devising a Growth Plan, Structure the Scaling Strategy, Devise a Customer acquisition strategy, Monitor KPIs and enhance Productivity via Process improvements, Operational Excellence, and Managing Sales Distribution, Identifying funding sources, Mapping Start-Up Cycle to Funding Options, Creating business valuation.

**Case Study:**

1. Torchit's social entrepreneurship brought in a revolution and impacted millions of lives.
2. Growing at 100x with 100X.VC The Art of Fundraising Home assignment: Presentation on growth and funding strategy ur.

**Assessment Activity**: Milestone 4 - Presentation on growth and funding strategy [CO4].

## REFERENCE BOOKS


1. Masters, B., Thiel, P. (2014). *Zero to one: notes on start ups, or how to build the future.* Random House.
2. Ferriss, T. (2017). *Tools of titans: The tactics, routines, and habits of billionaires, icons, and world-class performers.* Houghton Mifflin.
3. Lyons, D. (2016). Disrupted: My misadventure in the start-up bubble. Hachette UK.
4. Robbins, A., *Robbins, T., and Mallouk, P. (2017). Unshakeable: Your Financial Freedom Playbook.* Simon and Schuster.
5. Hansson, D. H., and Fried, J. (2010). *ReWork: Change the Way You Work Forever.* Random House.
6. Financial Management; *Text and Problems, 7th Ed., A Khan and P. K. Jain, Tata MacGraw Hill,* , 44th ISBN: 9789353162184.
7. Kapal, R. (2018). *Kites in a Hurricane: Startups from Cradle to Fame.* Sage Publications Pvt. Limited.
8. Koontz, H., O'Donnell, C., *Weihrich, H. (1986). Essentials of management (Vol. 18).* New York: McGraw-Hill.
9. Prasanna, C. (2001). *Financial Management Theory and Practice. Tata McGraw.* Tata MacGraw Hill.

**E-R ESOURCES**

1. Wadhwani Foundation - https://wadhwanifoundation.org/
2. Startup India Learning Program - https://www.startupindia.gov.in/content/sih/en/learning-and-development$_{v}2.html$

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | 2024 - 2025 (Rev. (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Applied Mathematics |
| | COURSE CODE | 2301254T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2301254T.CEO.1: To evaluate the rank, eigenvalues and eigenvectors of a matrix and solve the system of equations.
2301254T.CEO.2: To find the basis and dimension of vector spaces.
2301254T.CEO.3: To evaluate the derivative and line integral of complex valued functions.
2301254T.CEO.4: To evaluate the derivative and integration of vector-valued functions.
2301254T.CEO.5: To apply the concepts/laws of vector integral calculus to problems in engineering.
2301254T.CEO.6: To solve theoretically and execute the program on problems of numerical methods using MATLAB.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301254T.CO.1: Evaluate the rank, eigenvalues and eigenvectors of a matrix and solve the system of equations [L4].
2301254T.CO.2: Find the basis and dimension of vector spaces [L3].
2301254T.CO.3: Evaluate the derivative and line integral of complex valued functions [L4].
2301254T.CO.4: Evaluate the derivative of vector-valued functions [L4].
2301254T.CO.5: Evaluate line, surface area and volumes of objects using multiple integrals [L4].
2301254T.CO.6: Examine the given problem and choose appropriate numerical method for finding the solution to problems of interpolation, derivative and integration using MATLAB [L4].

## COURSE ABSTRACT

Applied mathematics involves the application of mathematics to problems which arise in various areas of science, engineering, medicine, finance, forecasting etc. and/or the development of new or improved methods to meet the challenges of new problems. Applied mathematics focuses on the creation and study of mathematical and computational tools broadly applicable in science and engineering, and on their use in solving challenging problems in these and related fields. This course mainly discusses the transform analysis used as a major tool to solve complex differential equations, numerical methods and applications of partial differential equations arising in the diverse areas of engineering and technology. As a part of the studies we emphasize more on real life applications of the topics and based on that different activities are also conducting in timely manner. By doing this we boost the curiosity of the students towards research.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Linear Algebra I** | **9 HOURS** |

**Contents:** Basic Concepts, Matrix Addition, Scalar Multiplication, Matrix Multiplication, Linear Systems of Equations, Rank of a Matrix, Eigenvalues, Eigenvectors, Symmetric Matrices, Skew-Symmetric Matrices, Orthogonal Matrices.
**Self Study:** Gauss Elimination Method.

| | | |
|---|---|---|
| **UNIT 2** | **Linear Algebra II** | **7 HOURS** |

**Contents:** Similarity of Matrices, Digonalization, Vector Spaces, Basis, Dimension of vector spaces, Linear Independence, Inner Product Spaces.
**Self Study:** High Dimensional Spaces.

| | | |
|---|---|---|
| **UNIT 3** | **Functions of Complex Variables** | **8 HOURS** |

**Contents:** Complex Numbers, Complex Plane, Polar Form, Powers, Derivative, Analytic Functions, Cauchy-Riemann Equations, Line Integrals in the Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula.
**Self Study:** Residue Theorem.

| | | |
|---|---|---|
| **UNIT 4** | **Vector Differentiation** | **7 HOURS** |

**Contents:** Vectors in 2-D and 3-D, Scalar Product, Vector Product, Vector/scalar functions and fields, Derivative of vectors, Velocity and Acceleration, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field.
**Self Study:** Vector Identities.

| | | |
|---|---|---|
| **UNIT 5** | **Vector Integration** | **7 HOURS** |

**Contents:** Line Integration, Line Integrals Independent of Path, Double Integrals Green's Theorem in the Plane, Surfaces for Surface Integrals. Surface Integrals, Volume Integrals, Divergence Theorem, Stoke's Theorem.
**Self Study:** Maxwell's Equations.

| UNIT 6 | Numerical Methods | 7 HOURS |
|---|---|---|

**Contents:** Numerical Differentiation and Integration, Interpolation: Finite Differences, Newton's and Lagrange's Interpolation. Numerical solution of System of linear equations by Gauss elimination method, LU- Decomposition method.

**Self Study:** Spline Interpolation.

## TEXT BOOK


1. Erwin Kreyszig, (2015), Advanced Engineering Mathematics, 10 th edition, Wiley Eastern Ltd.
2. Dr. B.V. Ramana, (2017), Higher Engineering Mathematics, 5 th edition, Tata McGraw Hill.


## REFERENCE BOOK


1. B.S. Grewal, (2018), Higher Engineering Mathematics, 44 th edition, Khanna Publications.


## E-R ESOURCES (NPTEL courses)

1. Linear Algebra By Prof. Dilip P. Patil — IISc Bangalore
2. Introduction to Abstract and Linear Algebra By Prof. Sourav Mukhopadhyay — IIT Kharagpur
3. Complex Analysis By Prof. Pranav Haridas — Kerala School of Mathematics
4. Mathematics -:Integral and Vector Calculus
5. Numerical Methods for Engineers By Prof. Niket Kaisare — IIT Madras
6. Numerical Methods By Mansoor P — MES College of Engineering Kuttippuram, Kerala

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | 2024 - 2025 (Rev. (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Applied Mathematics Lab |
| | COURSE CODE | 2301254L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2301254L.CEO.1: To impart the knowledge to the students with MATLAB software.
2301254L.CEO.2: To give students a basic understanding of MATLAB, including popular toolboxes.
2301254L.CEO.3: To enhance programming knowledge in Research and Development.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301254L.CO.1: Apply MATLAB conventions to solve engineering-related problems [L3].
2301254L.CO.2: Interpret basics of MATLAB to analyse and visualize data [L5].

**COURSE ABSTRACT**

The course utilizes the MATLAB environment to provide students with a working knowledge of computer-based problem-solving methods relevant to science and engineering, including programming and numerical analysis techniques. Students outline, write, test, and debug computer programs to solve problems and display results, with emphasis on proper documentation of computer code. Common examples and applications of engineering are used throughout the course.

| **PRACTICAL: Any 10 practicals are performed as per the requirement of a branch.** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Introduction to MATLAB: Syntax, keywords, matrices, polynomials, loops. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Introduction to MATLAB: In-built functions, 2D/3D plots, creating simple programs. | | |
| **PRACTICAL NO.03** | | **2 HOURS** |
| Finding Laplace transforms of functions, solution of differential equations using Laplace transforms/ Row Spaces. | | |
| **PRACTICAL NO.04** | | **2 HOURS** |
| Finding Fourier transforms of functions, Plotting of transforms/ Null Spaces. | | |
| **PRACTICAL NO.05** | | **2 HOURS** |
| Numerical Integration: Trapezoidal, Simpson's 1/3rd and Simpson's 3/8th rule. | | |
| **PRACTICAL NO.06** | | **2 HOURS** |
| Interpolation techniques: Lagrange's Interpolation. | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Interpolation techniques: Newton's Interpolation. | | |
| **PRACTICAL NO.08** | | **2 HOURS** |
| Solution of differential equation by modified Euler's method. | | |
| **PRACTICAL NO.09** | | **2 HOURS** |
| Solution of differential equation by Runge-Kutta method. | | |
| **PRACTICAL NO.10** | | **2 HOURS** |
| Curve Fitting: Linear, Quadratic. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.11** | | **2 HOURS** |
| Solution of algebraic equations: Newton- Raphson method. | | |
| **PRACTICAL NO.12** | | **2 HOURS** |
| Solution of algebraic equations: Bisection method. | | |
| **PRACTICAL NO.13** | | **2 HOURS** |
| Curve Fitting: Cubic, Exponential. | | |

**TEXT BOOK**

1. Amos Gilat, (2010), "MATLAB: An Introduction with Applications", 4th edition, Wiley Publication.

**REFERENCE BOOK**

1. Ram N. Patel and Ankush Mittal, (2014), "Programming in MATLAB- A Problem solving approach", Pearson Education.

**E-R ESOURCES (NPTEL courses)**

1. Matlab Programming for Numerical Computation By Prof. Niket Kaisare — IIT Madras
2. Scientific Computing using Matlab By Prof. Mani Mehra, Prof. Vivek K. Aggarwal — IIT Delhi

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2024 - 2025 (Rev. (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Project Design |
| | **COURSE CODE** | 2304291L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE:** Knowledge of engineering fundamentals.

**COURSE OBJECTIVES :**

2304291.CEO.1: To develop a sense of curiosity and critical thinking approach for designing solutions to the real world problems.

2304291.CEO.2: To disseminate the project planning-scheduling techniques and industry standards.

2304291.CEO.3: To cognize the ethical principles, industry standards in general and its importance in project documenting and ethical writing.

2304291.CEO.4: To encourage to integrate the multiple project design ideas.

2304291.CEO.5: To encourage to work in a team and cooperate the team members.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304291.CO.1: Design solutions for solving real world problems using critical thinking systematic approach [L3].

2304291.CO.2: Plan the project activities with respect to timeline, skills and resources required considering the project costs estimations [L3].

2304291.CO.3: Apply the knowledge of professional ethics and Industry standards for project design and documentation [L3].

2304291.CO.4: Demonstrate an ability to integrate the multiple project design ideas to develop the designs of product/ processes/ software [L4].

2304291.CO.5: Demonstrate an ability to work in a team and cooperate the team members by showing the responsible behaviour [L5].

## COURSE ABSTRACT

It is a need of the time to pay attention to the societal needs by an engineering graduate to solve some of the real life societal problems by providing affordable technological solutions. The concept of the field project follows the same theme. The project design aims to identify the problems that are faced by the society and develop the systems / processes / products to provide solutions for the same using science and technology for the betterment of society or human life. This may help students to understand the process of product/project development, best practices and encourage their creativity to solve real life problems. The students shall refer scientific literatures from the books, journals of repute. The students shall learn effective team building, designing, budgeting, planning, engineering skills and processes, safety norms and industry standards while developing the application/ products / processes. The students shall learn the importance of technical documentation and professional ethics.

## Guidelines

1. Every student shall undertake the Project in semester III and IV.
2. Every student shall work on an approved project, preferably a field project to work in a group of 03/04 (Max.) students.
3. The group members may be from different programme to support the interdisciplinary / multi-disciplinary functioning.
4. The students have to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
5. Collect the sufficient data and survey to establish the criticality of the problem to be solved.
6. Apply various tools for project planning and design.
7. Critically analyze various design solutions/techniques to solve real world problems.
8. Select and justify one of the solutions identified based on the feasibility, affordability and ease of use.
9. Learn and apply industry standards and professional ethics.
10. Adherence to the highest principles of ethics, conduct and practices.

## TIMELINE

The THREE member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Formation of Project Group and topic exploration: 2 Weeks ($1^{st}$ and $2^{nd}$ week)
2. Finalizing title, survey, feasibility study and approval: 3 Weeks ($3^{rd}$ to $5^{th}$ week)
3. Engineering Ethics: $3^{rd}$ week
4. Project Review 1 Presentation: $6^{th}$ week
5. Analysis and Design of the Project: 3 Weeks ($7^{th}$ to $9^{th}$ week)
6. Project Review 2 Presentation: $10^{th}$ week
7. Report Writing, Documentation and Presentation: 2 Weeks ($11^{th}$ and $12^{th}$ week)
8. Project report assessment by the guide and review panel: 2 Weeks ($13^{th}$ and $14^{th}$ week)
9. Final Evaluation/Examination Presentation: $15^{th}$ week

**Project Demonstration (50 Marks)**

1. **Review 1 (05 marks)**
   - Demonstrate an ability to define precise Problem Statement, Project objectives and Scope, Project Planning, application of Project management tools.
2. **Project Activities (05 Marks)**
   - Demonstrate an ability to identify situations of unethical professional conduct and propose ethical alternatives.
   - Demonstrate Commitment towards practicing the Professional Ethics and moral.
   - Demonstrate an ability to apply the Code of Ethics
3. **Review 2 (Project Modeling and Designing, Block diagram, Flow chart, etc.) (10 marks)**
   - Write detailed Literature Review, Need and Significance of Study, Methodology, Block Diagram, Flow Chart, Engineering drawings, etc.
4. **Project Documentation (10 marks)**
   - Produce clear, well-constructed, and well-supported written engineering documents, project cost sheet and plagiarism report.
5. **Final project demonstration & Project team presentation (20 marks)**
   - Demonstrate effective communication,Implement the norms of standard professional practices, Present results as a team showing the responsible behaviour.

**TEXT BOOKS**


1. Schmidt, T. (2009). Strategic Project Management Made Simple. 2nd Edition, Wiley Pub, India.(ISBN 978-1-119-71817-8)
2. Challender, J. (2022). Professional Ethics in Construction and Engineering", Wiley .(ISBN-13: 978-1-119-83210-2)
3. Rogerson, S. (2003) Computer Ethics and Professional Responsibility. 1st Edition Wiley Blackwell Publication.(ISBN-13: 978-1855548459)
4. Nagarazan, R.S. (2022). A Textbook on Professional Ethics and Human Values. New Age Publication, (ISBN-13: 978-81-224-2301-3)
5. Hering, L. and Hering H. (2005). How to write Technical Reports. Springer (ISBN : 978-3-540-69929-3)


**REFERENCE BOOKS**


1. Zwikael, O. and Smyrk, J. (2019). Project Management A Benefit Realization Approach. Springer Publication, (ISBN-13: 978- 0134877693)
2. Handley, W. (1977). Industrial Safety Handbook. 2nd Revised edition ,McGraw-Hill Companies;, (ISBN-13: 978-0070844810)
3. Mislick, G. and Mussbaum, D. (2015) Cost Estimation: Methods and Tools. Wiley, (ISBN-13: 978-1-118-53613-1)
4. Chilcutt, A. and Adam, J. (2019). Engineered to Speak: Helping You to Create and Deliver Engaging Technical Presentations. Wiley, (ISBN-13: 978-1-119-47496-8)

**E-RESOURCES**

1. University of California, free online course: https://www.classcentral.com/course/project-planning-1-12208
2. International Journal of Project Management : https://www.sciencedirect.com/journal/international-journal-of-project-management
3. Free software tool for project Management : https://onlinepmcourses.com/project-management-tools/free-project-management-resources/
4. Research Article: https://doi.org/10.1016/j.tsc.2024.101477
5. Research Article: https://doi.org/10.1016/j.ijproman.2024.102584

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2024 - 2025 (Rev. (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | ADVANCED DATA STRUCTURES |
| | COURSE CODE | 2304219T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 2.1 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE KNOWLEDGE :** Data Structures

**COURSE OBJECTIVES :**

2304219T.CEO.1: Introduce various data structures like trees, graphs, heaps, hash tables, disjoint sets etc.

2304219T.CEO.2: Demonstrate how to select appropriate data structures based on requirement of application.

2304219T.CEO.3: Discuss about the implementation of various real world applications using data structures.

2304219T.CEO.4: Explain about the evaluation of performance of data structures in terms of time and space complexity.

2304219T.CEO.5: Learn how to design own data structure using standard data structures.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304219T.CO.1: Illustrate the working of advanced data structures namely trees, graphs, heaps,d isjoint sets, hash tables, probabilistic data structures[L3].

2304219T.CO.2: Demonstrate the advantages and disadvantages of various data structures [L3].

2304219T.CO.3: Choose appropriate data structures to build applications for given real world problem statements [L3].

2304219T.CO.4: Develop various applications for specified problems using data structures such as trees, graphs and heaps [L3].

2304219T.CO.5: Evaluate performance of various data structures in terms of time and space complexity [L4].

2304219T.CO.6: Design own data structures using the built in data structures [L4].

**COURSE ABSTRACT:**

A good algorithm usually comes together with a set of good data structures that allow the algorithm to manipulate the data efficiently. The course Advance Data structures focuses on developing important technical concepts in the theories and practical applications of Data structures. Students will delve into the fundamental concepts of Trees, Balanced Trees, Graphs, Heaps, Disjoint sets, Hashing, Probabilistic data structures.

**THEORY COURSE CONTENTS**

| UNIT 1 | TREES | 09 HOURS |
|---|---|---|

**Applications/Case Study:** Parse trees and expression trees in Compiler.

**Contents:**Introduction to trees, Tree Terminology, General trees, Binary trees, KD tree, Tree as ADT, Conversion of general tree into binary tree, Representation of tree using sequential and linked list, Binary tree and its types, Properties of Binary trees, Binary search tree and operations on binary search tree, Depth First and Breadth First traversal, Tree traversal techniques: inorder, preorder, postorder traversal (recursive and non-recursive traversal),Threaded Binary Tree-concept, Operations on TBT( insert, delete, search, update and traversal), Time complexity and space complexity for tree operations, Applications of trees.

**Self Study:** Game trees

**Further Readings:** Optimal Binary Search Tree.

| UNIT 2 | HEIGHT BALANCED AND MULTIWAY TREES | 06 HOURS |
|---|---|---|

**Applications/Case Study:** BTRFS File System.

**Contents:** Height balanced trees concepts ,Types of height balanced trees and applications, AVL Trees and operations, Multiway trees: concepts, Types of multiway trees: B and B+ Trees operations on multiway trees and applications, Time complexity and space complexity for tree operations.

**Self Study:** Red Black Tree ,Trie Tree, Splay Tree.

**Further Readings:**: AA Trees and range queries..

| UNIT 3 | GRAPHS | 05 HOURS |
|---|---|---|

**Applications/Case Study:** Packet routing in networks.

**Contents:** Graph Concepts, Terminology,Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals - depth first and breadth first, Minimum spanning Tree, Prims and Kruskal Algorithms, Dikjtra's Single source and multi-source shortest path, Topological ordering applications of graphs.

**Self Study:** Warshall's algorithm..

**Further Readings:** Algorithms for connected components.

| UNIT 4 | HEAPS AND DISJOINT SETS | 05 HOURS |
|---|---|---|

**Applications/Case Study:** APriority queue.

**Contents:** Concept of Heaps, Types of heap, Operations on Heap – insert, delete, up-heapify and downheapify, use of heap in heap-sort, Fibonacci heap. Concept of Disjoint Sets, Disjoint Sets as ADT, Up Trees, Smart Union and Path compression.

**Self Study:** Binomial heap

**Further Readings:** Multidimensional Heaps.

| UNIT 5 | PROBABILISTIC DATA STRUCTURES | 05 HOURS |
|---|---|---|

**Applications/Case Study:** Recommendation System

**Contents:** Probabilistic data structures concept and Types of Probabilistic data structures: Member-ship Bloom Filters, Cuckoo Filters, Cardinality: Linear counting, HyperLogLog, Frequency: Count-Min Sketch , Similarity: Minhash, SkipLists , Applications of Probabilistic data structure structures.

**Self Study:**Counting Bloom Filter.

**Further Readings:** q-digest and t-digest data structures for ranking.

## TEXT BOOKS


1. Horowitz, Ellis, Sartaj Sahni, and Dinesh Mehta. (2008). *Fundamentals of data structures*. 2nd Edition, Universities Press . ISBN 978-8173716065.
2. Samanta, Debasis. (2009). *Classic data structures*. 2nd Edition, Prentice Hall India. ISBN 978-8120337312.
3. Brass, Peter. (2014). *Advanced data structures*. 2nd Edition, Cambridge University Press. ISBN 978-1107439825.


## REFERENCE BOOKS


1. Cormen, Thomas H., et al.(2009). *Introduction to Algorithms*. 3rd Edition, MIT Press. ISBN: 978-0262533058.
2. Gakhov, Andrii (2019). *Probabilistic Data Structures and Algorithms for Big Data Applications*. ISBN:978-3748190486


## E-RESOURCES

1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106106133
3. https://www.cse.iitb.ac.in/ ranade/cs213/
4. https://ocw.mit.edu/courses/6-851-advanced-data-structures
5. https://www.cs.bham.ac.uk/ jxb/DSA/dsa.pdf
6. https://www.cs.jhu.edu/ jason/226/
7. https://courses.csail.mit.edu/6.851/spring21/

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2024 - 2025 (Rev. (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | ADVANCE DATA STRUCTURES LAB |
| | COURSE CODE | 2304219L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.1 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Data Structures

**COURSE OBJECTIVES :**

2304219L.CEO.1: Introduce various data structures like trees, graphs, heaps, hash tables, disjoint sets etc.

2304219L.CEO.2: Demonstrate how to select appropriate data structures based on requirement of application.

2304219L.CEO.3: Discuss about the implementation of various real world applications using data structures.

2304219L.CEO.4: Explain about the evaluation of performance of data structures in terms of time and space complexity.

2304219L.CEO.5: Learn how to design own data structure using standard data structures.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304219L.CO.1: Choose appropriate data structures for solving a given problem statement [L3].
2304219L.CO.2: Develop functions to implement various operations to be performed using appropriate data structures [L3].
2304219L.CO.3: Demonstrate advantages and disadvantages of various data structures [L3].
2304219L.CO.4: Implement program for given real world problem using suitable data structures [L3].
2304219L.CO.5: Analyze the efficiency of different data structures for specified problem statement[L4].

**COURSE ABSTRACT:**

A good algorithm usually comes together with a set of good data structures that allow the algorithm to manipulate the data efficiently. The course Advance Data structures focuses on developing important technical concepts in the theories and practical applications of Data structures. Students will delve into the fundamental concepts of Trees, Balanced Trees, Graphs, Heaps, Disjoint sets, Hashing, Probabilistic data structures.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **BINARY SEARCH TREE** | **6 HOURS** |
| Design and develop a program in C++ to implement the following operations on Binary Search Tree: create, inorder traversal, preorder traversal, postorder traversal(for both recursive and non-recursive),delete a node, insert a node and level wise printing. | | |
| **PRACTICAL NO.02** | **THREADED BINARY TREE** | **4 HOURS** |
| Write a program in C++ to implement the following operations on Threaded Binary Tree : create, inorder traversal, preorder traversal, postorder traversal, inorder traversal, preorder traversal, postorder traversal(both recursive and non-recursive) . | | |
| **PRACTICAL NO.03** | **AVL TREE** | **6 HOURS** |
| Write a program in C++ to implement the following operations on AVL Trees: create, recursive inorder traversal, recursive preorder traversal, recursive postorder traversal, non recursive inorder traversal, non recursive preorder traversal, non recursive postorder traversal. | | |
| **PRACTICAL NO.04** | **MINIMUM SPANNING TREE.** | **4 HOURS** |
| Write a program in C++ to find the minimum spanning tree of a given graph using Prim's and Kruskal's algorithm. | | |
| **PRACTICAL NO.05** | **HEAPS** | **4 HOURS** |
| Write a program in C++ to implement heap sort algorithm to sort the given numbers in ascending and descending order | | |
| **PRACTICAL NO.06** | **PROBABILISTIC DATA STRUCTURES** | **6 HOURS** |
| Write a program in C++ to implement the following probabilistic data structures Bloom's Filter, and count-min sketch. | | |

## TEXT BOOKS


1. Horowitz, Ellis, Sartaj Sahni, and Dinesh Mehta. (2008). *Fundamentals of data structures*. 2nd Edition, Universities Press . ISBN 978-8173716065.
2. Samanta, Debasis. (2009). *Classic data structures*. 2nd Edition, Prentice Hall India. ISBN 978-8120337312.
3. Brass, Peter. (2014). *Advanced data structures*. 2nd Edition, Cambridge University Press. ISBN 978-1107439825.


## REFERENCE BOOKS


1. Cormen, Thomas H., et al.(2009). *Introduction to Algorithms*. 3rd Edition, MIT Press. ISBN: 978-0262533058.
2. Gakhov, Andrii (2019). *Probabilistic Data Structures and Algorithms for Big Data Applications*. ISBN:978-3748190486


## E-RESOURCES

1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106106133
3. https://www.cse.iitb.ac.in/ ranade/cs213/
4. https://ocw.mit.edu/courses/6-851-advanced-data-structures
5. https://www.cs.bham.ac.uk/ jxb/DSA/dsa.pdf
6. https://www.cs.jhu.edu/ jason/226/
7. https://courses.csail.mit.edu/6.851/spring21/

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2024 - 2025 (Rev. (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Database Management System |
| | COURSE CODE | 2304216T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Foundation of Computing

**COURSE OBJECTIVES :**

2304216T.CEO.1: To learn basic concepts of database management system,database transaction processing,concurrency control and Recovery.
2304216T.CEO.2: To learn key notions of query evaluations and optimization techniques.
2304216T.CEO.3: To develop database design using ER diagram.
2304216T.CEO.4: To develop database design with integrity constraints and Trigger.
2304216T.CEO.5: To understand the normalization techniques.
2304216T.CEO.6: To understand CRUD operations on SQL and NoSQL database

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304216T.CO.1: Illustrate the fundamental concepts of database management system, transaction processing,concurrency control and recovery. [L2]
2304216T.CO.2: Apply notions of query evaluations and optimization techniques. [L3].
2304216T.CO.3: Construct the ER model to solve the given problem[L3].
2304216T.CO.4: Design a well–formed relational database design(Schema) [L3]
2304216T.CO.5: Apply Normalization techniques to relational Schema[L3].
2304216T.CO.6: Execute CRUD operations on relational and non-relational database.[L3]

**COURSE ABSTRACT:**

A database management system is a software which allows creation,definition,and manipulation of the database,allowing users to store,process and analyse data easily. The course allows the learners with the learning of complete end to end development of an application developed using the UI and back end technologies.The data has to be mapped to different data models like the ER diagram,relational data model and then this has to be stored back into the database system.For effectively analyzing the stored data some query language is used. Here, in this course, the ORACLE or MYSQL can be used as a database system for storing and managing the data.The database must be created in such away that the data must be retrieved in an efficient manner. For this, the concept of normalization is applied to the database table. Finally, the ACID properties of any database application have to be maintained form a intaining the consistency of the data. The main objective of this course is to apply the basic operation of the database management system on the data generated through some application. Finally,the students must develop an end to end application considering some user requirements by applying front-end and back-end technologies.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION** | **08 HOURS** |

**Applications/Case Study:** Banking system,Student Information system using traditional file processing system

**Contents:** Introduction to Database system,Database System Vs file System,Data Abstraction, Instances and Schemas,Data Models- the ER Model,Relational Model,Other Models Mapping ER model to relational model. Case study ERD and Table design,System Structure,Database architectures:Centralized,Client Server,Parallel and Distributed Systems.

**Self Study:** Database Users and Administrator

**Further Readings:** Modeling concept for object oriented and object relational database.

| | | |
|---|---|---|
| **UNIT 2** | **RELATIONAL MODEL** | **08 HOURS** |

**Applications/Case Study:** Relational model for Banking system,University database

**Contents:** Structure of Relational Databases ,Database Schema,Schema Diagrams , Integrity Constraints over Relations-Key Constraints,Foreign Key Constraints,General Constraints,Relational Query Languages–Relational algebra,Tuple relational calculus.

**Self Study:**:Equivalence of relational calculus and relational algebra.

**Further Readings:**Domain relational calculus.

| | | |
|---|---|---|
| **UNIT 3** | **STRUCTURE QUERY LANGUAGE** | **08 HOURS** |

**Applications/Case Study:** SQL queries for Banking system, shop management system,Tiwtter data analysis

**Contents:** SQL Queries–Nested queries–Aggregate operators–Null values,Views,Index,PL/SQL block,exceptions,packages, looping,Concept of stored procedures,cursor,Triggers.

**Self Study:** Transaction control language–commit,Rollback,savepoints.

**Further Readings:**Recursive Queries

| UNIT 4 | DATABASE DESIGN AND QUERY PROCESSING | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Student Information system,Employee database system

**Contents:** Relational Database Design: Purpose of Normalization,Data Redundancy and Update Anomalies,Functional Dependencies. Decomposition–Armstrong's axiom. The process of Normalization: 1NF,2NF,3NF,BCNF.Query Processing:Overview,Measures of Query cost,Selection and Join operations,Evaluation of Expressions.

**Self Study:** Multi valued dependency,4NF

**Further Readings:**XML and web databases

| UNIT 5 | TRANSACTION MANAGEMENT | 08 HOURS |
|---|---|---|

**Applications/Case Study:** ATM system,Banking system

**Contents:** Basic concept of a Transaction, ACID Properties, Database Architecture, Concept of Schedule, Serial Schedule. Serializability: Conflict and View, Cascaded aborts Recoverable and Non-recoverable Schedules. Concurrency Control:Need Locking methods,Deadlocks,Time stamping Methods. Different crash recovery methods: Shadow-Paging, Log-based Recovery: Deferred and Immediate,CheckPoint.

**Self Study:** Buffer management and remote backup

**Further Readings:** ARIES Recovery

| UNIT 6 | NOSQL DATABASES | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Aadhar UIDAI system

**Contents:** Introduction to NOSQL database,Types of NoSQL Databases,ACID vs BASE,SQL vs NoSQL,MongoDB:Data Types,Documents,Collections,Database,CRUD Operations,Aggregation

**Self Study:** Pipeline and Indexing.

**Further Readings:** Multimedia Databases..

## TEXT BOOKS


1. Silberschatz A.,Korth H.,Sudarshan S.Database System Concepts. 6th Edition,McGrawHill Publishers,2006, ISBN978-0-07-352332-3.
2. Elmasri R., Navathe S., Fundamentals of Database Systems.4th Edition, Pearson, Education, 2003, ISBN8129702282D.
3. Pramod J Sadalage,Martin Fowler,NoSQL-Abrief guide to the Emerging World of Polyglot Persistence Distilled.Addison-Wesley, ISBN978-0-321-82662-6.
4. Raghu ramaKrishnan,Johannes Gehrke DatabaseManagement Systems3/e,TMH


## REFERENCE BOOKS


1. Rab P.Coronel C.Database Systems Design, Implementation and Management. 5th Edition,
2. Connally T.,Begg C .Database Systems3rd Edition,Pearson Education,2002,ISBN81-7808-861 4M.
3. Thoms on CourseTechnology,2002, ISBN981-243-135-7. .Date C., An Introduction to Database Systems 7th Edition,Pearson Education, 2002,ISBN81-7808-23
4. H Garcia-Molina, JD Ullman and Widom, Database Systems: The Complete Book 2ndEd.,PrenticeHall


## E-R ESOURCES

1. https://nptel.ac.in/courses/106106220
2. https://www.w3schools.com/sql/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** - 2024 (Rev. (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Database Management System Lab |
| | **COURSE CODE** | 2304216L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Foundation of Computing

**COURSE OBJECTIVES :**

2304216L.CEO.1: To develop database design using ER diagram.
2304216L.CEO.2: To develop database design with integrity constraints and Trigger.
2304216L.CEO.3: To understand the normalization techniques.
2304216L.CEO.4: To understand CRUD operations on SQL and NoSQL database.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304216L.CO.1: Construct the ER model to solve the given problem [L3].
2304216L.CO.2: Design a well –formed relational database design(Schema) [L3].
2304216L.CO.3: Apply Normalization techniques to relational Schema [L3].
2304216L.CO.4: Execute CRUD operations on relational and non-relational database.[L3]

**COURSE ABSTRACT:**

A database management system is a software which allows creation, definition, and manipulation of the database, allowing users to store, process and analyse data easily. The course allows the learners with the learning of complete end to end development of an application developed using the UI and backend technologies. The data has to be mapped to different data models like the ER diagram, relational data model and then this has to be stored back into the database system. For effectively analyzing the stored data some query language is used. Here, in this course, the ORACLE or MY SQL can be used as a database system for storing and managing the data. The database must be created in such a way that the data must be retrieved in an efficient manner. For this, the concept of normalization is applied to the database table. Finally, the ACID properties of any database application have to be maintained for maintaining the consistency of the data. The main objective of this course is to apply the basic operation of the database management system on the data generated through some application. Finally, the students must develop an end to end application considering some user requirements by applying front-end and back-end technologies.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **.** | **4 HOURS** |
| Design and draw an ER/EER diagram using standard notations for given problem definition and convert this diagram into Database Tables.Be sure to underline all primary keys, include all necessary foreign keys and indicate referential integrity constraints | | |
| **PRACTICAL NO.02** | | **10 HOURS** |
| For above example use SQL DML statement such as INSERT,UPDATE and DELETE to insert the data into tables and to update/delete the data inserted into/from tables. Write and execute SQL queries to extract information from the table. | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Create and perform Database Operations using Oracle as Back End and Java as Front End.Use JDBC connectivity. | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Implement following different types of PL/SQL blocks 1. Anonymous PL/SQLblock 2. Anonymous PL/SQL with cursor concept and Exception handling 3. Anonymous PL/SQL with For loop cursor concept4. Stored Procedure and Function 5.Trigger | | |
| **PRACTICAL NO.05** | **.** | **4 HOURS** |
| Design unstructured database and perform different operations on it. | | |
| **PRACTICAL NO.06** | **.** | **4 HOURS** |
| MINIPROJECT:Database Project Life Cycle Students have to complete a miniproject in agroup of minimum 3 and maximum 4 students.The problem statement for the project will be given to each group by the instructor in the first week of semester. Students can use either of the database systems (structured or unstructured)for completing their project . | | |

## TEXT BOOKS


1. Silberschatz A.,Korth H.,Sudarshan S.Database System Concepts. 6th Edition,McGraw Hill Publishers,2006, ISBN978-0-07-352332-3.
2. Elmasri R., Navathe S., Fundamentals of Database Systems.4th Edition, Pearson, Education, 2003, ISBN8129702282D.
3. Pramod J Sadalage,Martin Fowler,NoSQL-Abrief guide to the Emerging World of Polyglot Persistence Distilled.Addison-Wesley, ISBN978-0-321-82662-6.
4. Raghu ramaKrishnan,Johannes Gehrke DatabaseManagement Systems3/e,TMH


## REFERENCE BOOKS


1. Rab P.Coronel C.Database Systems Design, Implementation and Management. 5th Edition,
2. Connally T.,Begg C .Database Systems3rd Edition,Pearson Education,2002,ISBN81-7808-861 4M.
3. Thoms on CourseTechnology,2002, ISBN981-243-135-7. .Date C., An Introduction to Database Systems 7th Edition,Pearson Education, 2002,ISBN81-7808-23
4. H Garcia-Molina, JD Ullman and Widom, Database Systems: The Complete Book 2ndEd.,PrenticeHall


## E-R ESOURCES

1. https://nptel.ac.in/courses/106106220
2. https://www.w3schools.com/sql/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2024 - 2025 (Rev. (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | THEORY OF COMPUTATION |
| | **COURSE CODE** | 2304220T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** Requires knowledge of Discrete Structure

**COURSE OBJECTIVES :**

2304220T.CEO.1: To provide a comprehensive understanding of the fundamental concepts of theoretical computer science.

2304220T.CEO.2: To construct formal mathematical proofs for the correctness of algorithms and computational methods.

2304220T.CEO.3: To demonstrate the connection between automata and formal language theory and problem solving.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304220T.CO.1: Differentiate between all types of automata models, by analyzing their capabilities and limitations in solving computational problems. [L4]

2304220T.CO.2: Construct different kinds of grammars, automata from languages and from one to the other.[L3]

2304220T.CO.3: Apply formal mathematical methods to prove properties of languages, grammars and automata.[L3]

2304220T.CO.4: Decide on the appropriate type of automaton required to recognize a given language based on its structural complexity and properties.[L5]

2304220T.CO.5: Compare and contrast decidability of problems based on their properties.[L4]

**COURSE ABSTRACT:**

The Theory of Computation course covers foundational concepts in computer science, including finite automata, regular expressions, and context-free grammars, which are used to model and recognize patterns in strings and languages. Additionally, the course explores more advanced topics such as pushdown automata and Turing machines, which are models of computation capable of solving more complex problems. Students delve into topics of decidability, which concerns the question of whether certain problems can be solved algorithmically, and complexity theory, which analyzes the efficiency of algorithms and classifies problems based on their computational difficulty. Overall, the course provides students with a deep understanding of the theoretical aspects of computation, enabling them to analyze and solve problems in computer science with rigor and precision.

**THEORY COURSE CONTENTS**

| **UNIT 1** | **FINITE AUTOMATA** | **08 HOURS** |
|---|---|---|

**Applications/Case Study:** Working of Vending Machines, Parking Lot Gate Control System.
**Contents:** Introduction to Complexity Theory, computability Theory and Automata Theory , String, Alphabet and Languages, Regular Languages, Finite state Machines, Deterministic and Non Deterministic Finite state Machines, Epsilon NFA, Equivalence of the three Models, Minimization of Finite Automata, Finite Automata with output (Moore and Mealy Machines- Definitions, Models and Inter Conversion).
**Self Study:** Myhill-Nerode theorem.
**Further Readings:** Timed Automata, Hidden Markov Model, Transducers in NLP.

| **UNIT 2** | **REGULAR EXPRESSION** | **07 HOURS** |
|---|---|---|

**Applications/Case Study:** Pattern Matching, Grep utility of Linux, Text Processing and Search.
**Contents:** Operators of Regular Expression, Precedence of Operators, Building Regular Expression, Algebraic Laws for Regular expression, Conversions: RE to NFA-DFA using Thompson's construction, DFA to RE using Arden's theorem, State Elimination Method. Use of Regular Expression in practical programming, Regular expression equivalence Closure Properties of Regular languages, Pumping Lemma for Regular Languages.
**Self Study:**Decision properties of RE, Application of regular expressions in Lexical Analysis, Web scrapping
**Further Readings:**Regular expression in information retrieval, Exploring online interactive tools for regular expression validation and testing. (ex. RegexPal,RegExr, Regex101.)

| **UNIT 3** | **CONTEXT FREE GRAMMAR** | **07 HOURS** |
|---|---|---|

**Applications/Case Study:** Design of Parser for Compilers or Interpreters/ Web crawler.
**Contents:** Context Free Language Models, context free grammars, Ambiguous Grammar, Removing ambiguity, Simplification of CFG, Chomsky Normal Form(CNF), Greibach Normal Form(GNF), Closure Properties, Chomsky Hierarchy, Regular Grammar.
**Self Study:** Application of CFGs in XML and DTD, Decision Properties of CFL.
**Further Readings:**Exploring web-based CFG tools, Chart parsing, CYK parsing, Early parsing.

| UNIT 4 | PUSHDOWN AUTOMATA | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Parsing Arithmetic Expressions with Pushdown Automata (PDA).
**Contents:** Introduction to Pushdown Automata, Pushdown Automata Design, Deterministic Pushdown Automata, Non – Deterministic Pushdown Automata Design, Pushdown Automata to Context free grammar and Vice Versa, Closure properties. Pumping lemma for context-free languages.
**Self Study:** Multi – Stack Push Down Automata
**Further Readings:**Post Machines, Linear Bounded Automata,Python Libraries (PDAsim, PDAteach)

| UNIT 5 | TURING MACHINE | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Memcomputing, Von Neuman Architecture
**Contents:** Introduction to Turing Machines, Relationship to other automata models (Finite Automata, Pushdown Automata), Components of Turing Machines, Designing T.M for different set of problems, Universal T.M, Recursive Sets, Church's T.M, Halting Problem.
**Self Study:** Multi Tape Turing Machines, Explore the Online Turing Machine Simulator TM Visualization.
**Further Readings:** Non Deterministic Turing Machine,Explore the Online Turing Machine Simulator and TM Visualization.

| UNIT 6 | DECIDABILITY AND COMPLEXITY THEORY | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Travelling Salesman Problem, Hamiltonian Cycle Problem.
**Contents:** Introduction to Decidability, Decidable and Undecidable language, Decidable problems concerning regular languages and Undecidable Problems: Post's correspondence problem, non-recursively enumerable language, Introduction to Complexity Theory, Computational complexity classes (P, NP, NP-hard, NP-complete), Polynomial-Time Reductions, NP-Completeness, Tractable and Intractable Problems, and Representing Satisfiability
**Self Study:** 3 SAT Problem
**Further Readings:** Simple Reducibility Problem.

## TEXT BOOKS


1. John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman (2008). *Introduction to Automata Theory Languages And Computation*. 3rd Edition, Pearson.ISBN 978-8131720479
2. Michael Sipser (2014). *Introduction to the Theory of Computation*. 3rd Edition, Cengage Learning.ISBN-13: 978-131525296
3. Dexter C. Kozen (2013). *Automata and Computability*. 1st Edition, Springer Publishers.ISBN 978-3642857065.


## REFERENCE BOOKS


1. Vivek Kulkarni(2013). *Theory of Computation*. 1st Edition, Oxford University Press,ISBN: 978-0198084587
2. George Tourlakis (2014).*Theory of Computation*. 1st Edition, Willey,ISBN:978-1118315354


## E-BOOKS/E-CONTENTS LINKS (if any)

1. Theory of Computation By Anil Maheshwari and Michiel Smid Carleton University
2. https://nptel.ac.in/courses/106/104/106104148/
3. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman,"Introduction to Automata Theory Languages and Computation

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2024 - 2025 (Rev. 2022) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Object Oriented Programming (Core Java) |
| | **COURSE CODE** | 2304268L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 0.1 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE KNOWLEDGE :** Problem Solving Using OOP(CPP)

**COURSE OBJECTIVES :**

2304268L.CEO.1: To design and program stand-alone Java applications.
2304268L.CEO.2: To extend Java classes with inheritance and dynamic binding.
2304268L.CEO.3: To use exception handling and file handling in Java applications.
2304268L.CEO.4: To design a graphical user interface (GUI) with Java Swing.
2304268L.CEO.5: To implement database applications.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304268L.CO.1: Implement Object Oriented Programming Concepts in java. [L3]
2304268L.CO.2: Construct packages and interfaces in Java[L3]
2304268L.CO.3: Develop GUI-based java applications. [L3]
2304268L.CO.4: Utilize logic building traits efficiently for solving real life problems. [L3]
2304268L.CO.5: Implement applications using JDBC [L3]

## COURSE ABSTRACT:

Core Java is the Skill Development Course. The basic aim of the course is to introduce the students to Object Oriented Programming using Java. and make their concepts clear for designing real time applications using the same. The inclusion of Challenging Problems in the course will enhance students' logical thinking and boost their analytical skills. Various stages in problem solving will help students to deal with complex problems easily. This course will improve students problem solving abilities and coding skills.

## CONTENTS :

Basics of Java, Data Types and Variables, Operators, Control Statements,Looping, Arrays; String, String Buffer, String Builder; Methods, Lambda Expression, Constructor; Object Oriented Programming System : Classes and Objects, Modifiers, Inner Classes; Inheritance; Super,This,Static and Final Keywords; Polymorphism: Method Overloading, Method Overriding; Abstraction, Interfaces; Exception Handling, Create Own Exceptions; Multi threading ; Packages, Collections Framework; File Handling; Generics; Introduction to Swing: Layout Management , Swing Components ,Text Fields , Text Areas ,Buttons, Check Boxes, Radio Buttons , Lists, Choices, Scroll bars , Windows ,Menus , Dialog Boxes. JDBC Programming .

Self Study: Bytecode in Java ,Bytecode vs Machine code, JRE, Java API, JVM in Java, JVM Architecture, Class Loader,Interpreter in Java Interpreter vs Compiler,Download Install Java Development Kit JDK,Download Eclipse IDE for Java Developers.

| PRACTICAL: All assignments should be performed considering real-world applications. | | |
|---|---|---|
| **PRACTICAL NO.01** | **FUNDAMENTALS OF JAVA** | **6 HOURS** |
| a) Write a program based on the basics of Java<br>b) Implement a program using Control Statement, Looping, Array<br>c) Program for implementing string operations | | |
| **PRACTICAL NO.02** | **CLASS-OBJECT, METHODS, CONSTRUCTORS** | **6 HOURS** |
| a) Write a program to create Class, declare Member Variables, Define Methods<br>b) Program to define Constructor, Passing Information to a Method or a Constructor. | | |
| **PRACTICAL NO.03** | **JAVA INHERITANCE** | **4 HOURS** |
| a) Program to implement all types of Inheritance<br>b) Write a Java program to create a base class Sports with a method called play(). Create three subclasses: Football, Basketball, and Rugby. Override the play() method in each subclass to play a specific statement for each sport. | | |
| **PRACTICAL NO.04** | **STATIC, FINAL , SUPER AND THIS KEYWORD** | **2 HOURS** |
| a) Program to implement static, final , super and this keyword in java | | |
| **PRACTICAL NO.05** | **POLYMORPHISM** | **4 HOURS** |
| a) Program to implement polymorphism<br>b) Write a Java program to create a class Vehicle with a method called speedUp(). Create two subclasses Car and Bicycle. Override the speedUp() method in each subclass to increase the vehicle's speed differently. | | |
| **PRACTICAL NO.06** | **JAVA ABSTRACT CLASS, INTERFACES, LAMBDA EXPRESSION** | **4 HOURS** |
| a) Write a program based on Abstract Class<br>b) Write a program based on Interfaces<br>c) Program to define lambda expression | | |
| **PRACTICAL NO.07** | **EXCEPTION HANDLING** | **4 HOURS** |
| a) Implement a program to handle different exceptions<br>b) Implement a program to create own exception class | | |

| PRACTICAL NO.08 | JAVA THREAD | 4 HOURS |
|---|---|---|
| a) Write a Java program to create a basic Java thread that prints ”Hello, World!” when executed.<br>b) Write a Java program that creates two threads to find and print even and odd numbers from 1 to 20. | | |
| **PRACTICAL NO.09** | **PACKAGES AND COLLECTIONS** | **4 HOURS** |
| a) Implement a program to create own package<br>b) Implement a program based on Java collections | | |
| **PRACTICAL NO.10** | **FILE HANDLING** | **4 HOURS** |
| a) Write a Java program to get a list of all file/directory names in the given directory.<br>b) Write a Java program to read file content line by line. | | |
| **PRACTICAL NO.11** | **JAVA SWING** | **4 HOURS** |
| a) Write a program to create Frame and make use of Layout Management, User Interface Components<br>b) Write a program to create GUI based application using swing | | |
| **PRACTICAL NO.12** | **JDBC** | **6 HOURS** |
| a) Write a JDBC application which will interact with Database and perform the following task.<br>1) Create Student Table with RollNo, Name, and Address field and insert few records.<br>2) Display the content of Record.<br>3) Insert Two Records.<br>4) Update One Record.<br>5) Delete One Record. | | |
| **PRACTICAL NO.13** | **JAVA GENERICS** | **2 HOURS** |
| a) Write a Java program to create a generic method that takes two arrays of the same type and checks if they have the same elements in the same order<br>b) Write a Java program to create a generic method that takes a list of numbers and returns the sum of all the even and odd numbers. | | |

| PRACTICAL NO.14 | Mini Project: Sample Topics | 6 HOURS |
|---|---|---|

a) Energy billing system

b) Medical store stock management system

c) Gaming Application

d) Library book issue management system

e) Restaurant Management System

f) Online bus reservation system

Implement Using: The concept of Swing and JDBC

**Instructional Method**

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by white board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students
3. A Practical examination will be conducted at the end of the semester for evaluation of the performance of students in the laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, and Virtual Laboratory
5. Only one mini-project is planned to be undertaken by a student. Groups have to be formed for a project, the number of students in the group should not exceed three.
6. Each project should encompass two or three COs. The students need to give the project presentation at the end of the semester for assessment.

## TEXT BOOKS


1. Herbert Schildt.(2021). "Java The complete reference", 12th Edition, McGraw Hill Education.
2. Cay S. Horstmann, Gary cornell.(2021). "Core Java Volume –I Fundamentals", 12th Edition, Prentice Hall.


## REFERENCE BOOKS


1. K. Arnold and J. Gosling. (2005)."The JAVA programming language", Fourth edition, Pearson Education.
2. Timothy Budd. (2000). "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education.
3. C. Thomas Wu. (2006). "An introduction to Object-oriented programming with Java", Fourth Edition, Tata McGraw-Hill Publishing company Ltd.


## E-R ESOURCES

1. https://nptel.ac.in/courses/106105191

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2024 - 2025 (Rev. (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Enterprise Application Development (Advanced Java) |
| | **COURSE CODE** | 2304269L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Requires knowledge of Problem Solving Using OOP(Java)

**COURSE OBJECTIVES :**

2304269.CEO.1: To Apply the core Java fundamentals to learn the advanced concepts in J2SE

2304269.CEO.2: To make use of Servlet and JSP API in the process of enterprise application deployment

2304269.CEO.3: To Development of web application having collaboration of Servlets, JSPs, JSF, Spring and Hibernate based upon the requirement.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304269.CO.1: Construct java applications using OOP, JDBC and multithreading concepts. [L3]

2304269.CO.2: Utilize Servlet and JSP API in the process of enterprise application deployment. [L3]

2304269.CO.3: Build web application using Servlets, JSPs, Spring, Hibernate, and database, based upon the requirement. [L3]

2304269.CO.4: Develop programs using socket programming [L3]

**COURSE ABSTRACT:**

The Skill Development Course offered for SY BTECH Students. Based on object-oriented concepts and Advanced Java concepts, this course will equip the students with the required knowledge and skill of object-oriented programming approach needed for the development of robust, powerful web applications. This course develops the programming ability of students to create dynamic web applications using server-side technology with Java Database Connectivity. Students can learn networking and remote method invocation using Java API. Different Java frameworks like Spring, Java Server Faces, and Hibernate will increase the ability of students in web application development.

**CONTENTS :**

1. J2EE and Web Development
2. JDBC Programming
3. Multithreading
4. Networking
5. Servlet
6. Java Server Pages (JSP)
7. Hibernate
8. Java Web Frameworks: Spring
9. Java Server Faces

**PRACTICAL: All assignments should be performed considering real-world applications.**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Core Java Fundamentals** | **4 HOURS** |

a) Write a program using Exception Handling, Abstraction, and Package

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **JDBC** | **4 HOURS** |

a) Write a JDBC application which will interact with Database and perform the following task.

1) Create Student Table with RollNo, Name, and Address field and insert few records.

2) Display the content of Record.

3) Insert Two Records.

4) Update One Record.

5) Delete One Record.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Multithreading** | **6 HOURS** |

a) Implement a program to Create thread, scheduler, thread methods all

b) Program to implement thread using runnable interface and creating multiple thread

c) Write a program to priorities of thread, Thread pool, thread group.

| PRACTICAL NO.04 | Networking | 6 HOURS |
|---|---|---|

a) Write a program to retrieve IP address for given website and content of the given URL

b) Implement a program to connection-oriented communication and connection-less communication.

**Practice Problem:** 1)Write a java networking program to create a chat application using Connection-oriented communication.

| PRACTICAL NO.05 | Servlet | 8 HOURS |
|---|---|---|

a) Write a program for simple servlet, testing servlet and deployment descriptor

b) Implement program using doget and doPost method, life cycle of servlet.

c) Write a program to create servlet file for different database operation.

d) Implenet a program for error handling, authentication and context interface

**Practice Problem:** 1) Create an Employment Registration form and display the values entered by the user in another page using servlet.

2) Write a servlet program to store and display student details data from a student database table.

3) Write a Servlet program for checking voting eligibility of users and displaying appropriate messages.

| PRACTICAL NO.06 | Java Server Pages (JSP) | 6 HOURS |
|---|---|---|

a) Write a program based on JSP actions and Objects

b) Implement a program for cookies handling and session tracking

c) Write a program to demonstrate the core, format, function, and SQL tags of JSTL

**Practice Problem:** 1) Write a JSP program to create a simple user login page and display appropriate messages to demonstrate URLRewriting using sendRedirect .

2) Write a JSP program to calculate and pay the electricity bill generated given total units consumed and cost per unit as input from user

3) Write a JSP program to enter the marks of five subjects and display the result using the include directive.

| PRACTICAL NO.07 | Hibernate | 6 HOURS |
|---|---|---|

a) Program to implement Hibernate.

b) Implement Hibernate Annotations.

c) Implement Hibernate Query Language and types of relation

**Practice Problem:** 1) Write a hibernate program to create a Grocery database to store information of products like Product id, name, category, price per quantity, total quantity, quantity sold, quantity left, total price and total sales. Store the record of 20 products belonging to 5 different categories and display the following information (Apply Suitable Annotations). i) Record of all products. ii)Record of all products with sales greater than 50000.

2) Write a hibernate program to create an Employee database to store information of employees like employee id, name, department, designation, manager, salary , tax payable, date of joining. Store the record of 20 employees and display the following information (Apply Suitable Annotations). i) Record of all employees ii) Record of employee with salary greater than 35000

| PRACTICAL NO.08 | Java Web Frameworks: Spring | 8 HOURS |
|---|---|---|

a) Write a program to implement MVC using Spring Framework.

b)Write a program for Inject Service using Aspect Oriented Programming.

c) Implement Jdbc Template,Spring ORM, Spring MVN

d) Implement a program for Spring Template manages, Spring Transaction Management, Spring Restful Services

**Practice Problem:** 1) Write a Spring MVC program to create a Bank Account Registration form and implement data modeling from view to controller to view again using Model and View class and RequestParam Annotation.

2) Write a Spring MVC program to create a Blood Donation Registration form and implement data modeling from view to co13.Write a Spring MVC program to create a Bank Account Registration form and implement data modeling from view to controller to view again using Model object class and RequestParam Annotation.

3) Write a Spring ORM program to implement menu driven program for a Grocery Store and perform following operations i) Adding new Grocery Items ii) Display information of all Grocery Item

4) Write a Spring ORM program to implement menu driven program for a Online Food Ordering System and perform following operations i)Adding new Food Items ii) Display information of all Food Item

| PRACTICAL NO.09 | Java Server Faces | 4 HOURS |
|---|---|---|

a) Write a program for JSF Standard Components and Facelets Tags.

b)Write a program for JSF Converter Tag and Validation Tags.

| PRACTICAL NO.10 | Mini Project: Sample Topics | 8 HOURS |
|---|---|---|

a) Energy billing system

b) Medical store stock management system

c) Library book issue management system

d) Restaurant Management System

e) Online bus reservation system

**Instructional Method**

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by white board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory.
3. Practical examination will be conducted at the end of the semester for evaluation of performance of students in the laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, and Virtual Laboratory
5. Only one mini-project is planned to be undertaken by a student. Groups have to be formed for a project, the number of students in the group should not exceed three.
6. Each project should encompass two or three COs. The students need to give the project presentation at the end of the semester for assessment.

**TEXT BOOKS**


1. Java Server Programming Java EE 7 (J2EE 1.7), Black Book
2. Complete Reference J2EE by James Keogh mcgraw publication


**REFERENCE BOOKS**


1. Professional Java Server Programming by Subrahmanyam Allamaraju, Cedric Buest Wiley Publication
2. Hibernate 2nd edition, Jeff Linwood and Dave Minter, Beginning Après publication
3. JDBC™ API Tutorial and Reference, Third Edition, Maydene Fisher, Jon Ellis, Jonathan Bruce, Addison Wesley
4. Beginning JSP, JSF andTomcat, Giulio Zambon, Apress

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2024 - 2025 (NEP Rev. ) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | ENGINEERING INFORMATICS |
| | **COURSE CODE** | 2301232T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301232T.CEO.1: To introduce facts, concept and theory of an information system.
2301232T.CEO.2: To understand importance of Data collection and data analysis for system implementation.
2301232T.CEO.3: To understand Data presentation and effective communication and storage for a system.
2301232T.CEO.4: To make aware about the importance of Engineering Design and Innovative business.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2301232T.CO.1: Identify data collection, processing, and analysis techniques for various systems in the real life applications[L3].
2301232T.CO.2: Develop Data Acquisition System for Collect, store, and manage large sets of engineering data, ensuring data integrity and accessibility for analysis based on the real life application[L3].
2301232T.CO.3: Analyze communication modes and storage techniques for data transmission and reception for data acquisition system[L4].
2301232T.CO.4: Analyze real time application and develop a Engineering design to grow in business. [L4].

**COURSE ABSTRACT:**

Engineering Informatics is the course focusing soft skill development of students like decision making, analysis and presenting the information in effective manner. As per the industry demand automation is one of the important area to focus, decision making using automated machine interference is crucial in industry 4.0. To make strong decision making process, it is necessary to collect the data base, obtain the correct information, covert it into knowledge and visualize it using human and machine interface. This process must follow the information life cycle and its stages. The journey to make decision is explained and demonstrated in the course. Course contents also focus on recent development in the sector of green sustainability, Infrastructure and Sustainability, Artificial Intelligence (AI) and Machine Learning (ML), Data Science, Cloud Computing, Healthcare and Block-chain Technologies, Generative AI, Robotics, Business, Entrepreneurship and Engineering Design functioning and real time project implementation is the integral part of this curriculum. The course emphasizes adaptability, critical thinking, and keeping up with emerging trends in the fast-evolving field of technology as a life long learning.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Fundamentals of Data Collection and Analysis** | **08 HOURS** |

**Applications/Case Study:** Retail operations with minimized footprint

**Contents:** Overview of data and its types, Data survey and data segregation in various types. Importance of green sustainability, Infrastructure and Sustainability. Introduction to Eco-friendly product life-cycle. Information Life Cycle - Types of Information System - Transaction Processing System, Management Information System, Decision Support System. Application discussion - Eco-friendly public transport.

**Further Readings:** Energy-efficient products and materials. Vertical forest buildings.

| | | |
|---|---|---|
| **UNIT 2** | **Information Collection and Processing** | **07 HOURS** |

**Applications/Case Study:** Remote patient monitoring system and Data-driven precision agriculture system.

**Contents:** Data Acquisition system, Data Collection Methods: Human Interface [ Interview, Interrogation, Survey and Observation ] Hardware Interface [ Digital Data Acquisition System ] Software interface [ Web scrapper ] Data Processing Cycle Data Processing Stages Design of Experiment.

**Further Readings:** AI-based music recommendations and Predicting customer needs and prediction.

| | | |
|---|---|---|
| **UNIT 3** | **Data Storage, Transmission, Security, Analysis** | **07 HOURS** |

**Applications/Case Study:** Real-time stock prediction.

**Contents:** Cloud-based file sharing and backup, Introduction to data transmission, transmission modes, Data storage. Data security and privacy : Encryption Decryption Data Analysis: Blockchain for secure trade financing. Rights management for artists, business and property - Introduction.

**Further Readings:** Authenticity and provenance tracking.

| UNIT 4 | Innovative Business and Engineering Design | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Automated EV manufacturing

**Contents:** Building a customer-centric culture, Empowering entrepreneurs with e-commerce solutions. Industrial design and user experience innovation. Iconic ergonomic design for branding. Effective product differentiation and marketing. Generative AI assistant, voice assistant, Chatbot - For business model

**Further Readings:** Sustainable design with customer satisfaction. Siri business model.

## TEXT BOOKS


1. Ralph M Stair, George W Reynolds. (2022). *Fundamentals of Information Systems*.. 6th Edition, McGraw Hill Publishers. ISBN 9781423925811.
2. Benny Raphael, Ian F. C. Smith. (2017). *Engineering Informatics: Fundamentals of Computer Aided Engineering*. 2nd Edition, Wiley-Blackwell. ISBN 9781119953418.


## REFERENCE BOOKS


1. Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., Wallace, K., Blessing, L. (2022). *Engineering Design: A Systematic Approach*. 1st Edition, Springer, Auerbach Publications. ISBN: 978-1846283185..
2. Adrian McEwen, Hakim Cassimally (2023). *An Designing the Internet of Things*. 7th Edition, Wiley Publication. ISBN 9781118430620.


## e - Content

1. https://youtu.be/zQS8siOoiu8
2. https://youtu.be/9ce1FbFO/YQ?list=PLFW6lRTa1g80R3Q/5-jsNVhDFAeGaABo9

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2024 - 2025 (NEP Rev. ) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | ENGINEERING INFORMATICS LAB |
| | **COURSE CODE** | 2301232L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301232L.CEO.1: To introduce facts, concept and Implementation of DAS of an information system.
2301232L.CEO.2: To understand evolution of an information system.
2301232L.CEO.3: To make aware about IoT based information system.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2301232L.CO.1: Design and Develop an Automation System using Simulation Software [l4]
2301232L.CO.2: Develop Data Visualization Techniques for effective communication of information for professional dashboard design[L5].
2301232L.CO.3: Design and Development of an Automation System using Microcontroller / Microprocessor [l5]

**COURSE ABSTRACT:**

Engineering Informatics is the course focusing soft skill development of students like decision making, analysis and presenting the information in effective manner. As per the industry demand automation is one of the important area to focus, decision making using automated machine interference is crucial in industry 4.0. To make strong decision making process, it is necessary to collect the data base, obtain the correct information, covert it into knowledge and visualize it using human and machine interface. This process must follow the information life cycle and its stages. The journey to make decision is explained and demonstrated in the course. Course contents also focus on recent development in the sector of green sustainability, Infrastructure and Sustainability, Artificial Intelligence (AI) and Machine Learning (ML), Data Science, Cloud Computing, Healthcare and Block-chain Technologies, Generative AI, Robotics, Business, Entrepreneurship and Engineering Design functioning and real time project implementation is the integral part of this curriculum. The course emphasizes adaptability, critical thinking, and keeping up with emerging trends in the fast-evolving field of technology as a life long learning.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Simulation of IoT Systems** | **6 HOURS** |

Deploy an IoT based automation system for controlling various appliances such as fan, lights, water pumps etc.

A.1: Identify the home appliances that require human interaction for its operations.

A.2: State the need of automation.

A.3: Identify system component.

A.4: Design circuit diagram.

A.5: Assemble system components.

A.6: Program the interface.

A.7: System Testing.

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Data Acquisition , Storage and Retrieval Systems using Arduino / Raspberry Pi** | **12 HOURS** |

Deploy an IoT based automation system in the sector of Smart Agriculture, Smart Home Automation, Smart City, Disaster management, Military applications, Industrial automation etc and develop a IoT based system which will include following,

A.1: Identification of an interdependent elementary data items which have facts and figures.

A.2: Design circuit diagram.

A.3: Data collection through sensors.

A.4: Processing using Arduino / Node MCU A.5: Data Storage on cloud through Thinkspeak.

A.6: Device control using mobile Apps or through Web pages.

A.7: Data storage in file format.

| PRACTICAL NO.03 | Data Presentation & Visualization | 10 HOURS |
|---|---|---|

Identify the data set containing thousands of records related to Smart Agriculture, Smart Home Automation, Smart City, Disaster management, Military applications, Industrial automation etc and develop a system to represent and visualize the data professionally. Make use of open source software tool like, OpenHAB, Power BI, Jupyter Notebook etc. Prepare the Dash Board by following given steps,

A.1: Data selection for presentation and visualization.

A.2: Selection of appropriate data presentation format, graphs.

A.3: Selection of Software tool.

A.4: Preparation of Dash Board for selected data.

A.5: Demonstration of Data presentation Visualization.

## TEXT BOOKS


1. Ralph M Stair, George W Reynolds. (2016). *Fundamentals of Information Systems.*. 6th Edition, McGraw Hill Publishers. ISBN 9781423925811.
2. Benny Raphael, Ian F. C. Smith. (2017). *Engineering Informatics: Fundamentals of Computer Aided Engineering*. 2nd Edition, Wiley-Blackwell. ISBN 9781119953418.


## REFERENCE BOOKS


1. Gerard Jounghyun Kim. (2022). *Human Computer Interaction: Fundamentals and Practice.*. 1st Edition, CRC Press, Auerbach Publications. ISBN 9781482233896.
2. Adrian McEwen, Hakim Cassimally (2023). *An Designing the Internet of Things*. 7th Edition, Wiley Publication. ISBN 9781118430620.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF DESIGN | W.E.F | AY: 2024 - 2025 (Rev. (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Prototyping |
| | COURSE CODE | 23BD251 |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | NEP 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**COURSE OBJECTIVES :**

23BD251.CEO.1: To disseminate different types of prototyping tools and techniques.
23BD251.CEO.2: To impart the product development cycle through prototype projects.
23BD251.CEO.3: To inculcate hands-on skills for the development of prototyping as a team.
23BD251.CEO.4: To develop the ability to transmit multi-prototype information clearly and test the same by demonstration and presentation.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

23BD251.CO.1:Demonstrate the techniques, skills and modern engineering tools [L2].
23BD251.CO.2:Apply multi-skills to build/develop/prepare a prototype [L3].
23BD251.CO.3:Differentiate and operate various tools and machines [L3].
23BD251.CO.4:Illustrate the work carried out in a team [L4].

**PRACTICAL**

**Course Introduction:**

This course aims to work on a product/prototype development process based on multi-disciplinary aspects such as Mechanical, Civil, Computer, and Chemical modules. The main objective of this course is to learn different types of prototyping techniques, product development processes, etc. Students will learn to design, build and debug different engineering interdisciplinary products as a prototypes in team. Students will complete four modules in a rotational manner. Following is a brief introduction of individual modules such as,

1. Mechanical Prototyping (MP): Students will learn the different principles of Rapid Prototyping Techniques(RPT), model slicing, and 3D printing processes to manufacture a prototype through hands-on experience.

2. Civil Prototyping (CP): Students will learn basic skills of civil engineering and its product design. They perform tasks using concepts of Bamboo Architecture Design, and bamboo joinery by scaling down the structure prototype from selected materials.

3. Software Prototyping (SP): Students will get exposure to the software development life cycle (SDLC), and the use of the AEIOU Framework (Design Thinking) to decide the problem statement and its solution.

4. Chemical Prototyping (CHP): Students will learn and develop different chemical products in the form of chemical prototypes. They will prepare basic products such as sanitizer, bio-diesel, sanitizer, pen ink, soap, etc.

| **MODULE: 1/4** | **Mechanical Prototyping (MP)** | **16 HOURS** |
|---|---|---|

**PRACTICAL:**

| **PRACTICAL NO. 01** | **Introduction to Prototyping** | **02 HOURS** |
|---|---|---|

1. Introduction to prototyping, types of various prototypes, traditional prototyping vs. advanced rapid Prototyping. Types of rapid prototyping techniques.
2. Demand, applications, and growth of 3D printing in product development.
3. Case studies and need of prototypes in emerging fields like Bio - medicals, defense, manufacturing, aerospace, automobile industry, food industry, aviation,etc.

| **PRACTICAL NO. 2** | **Basics of CAD Modeling** | **02 HOURS** |
|---|---|---|

1. Introduction of 2D, 3D modelling using CAD software package.
2. Sketcher-workbench and its applications.
3. Part design workbench with generative sketching. Identify physical constraints of prototyping.

| PRACTICAL NO. 3 | 3D Modeling for Prototyping | 04 HOURS |
|---|---|---|

1. Introduction of 3D modeling and its interaction with prototype machines
2. Geometric modeling, types of geometric models, and solid models.
3. Case study on design based models.

| PRACTICAL NO. 04 | Pre-processing of 3D Model Slicing | 02 HOURS |
|---|---|---|

1. Pre-Processing the 3D Model in Cura software / 3D Slicer/ Eiger for slicing.
2. Selection of orientation of model, support generation, skin and wall thickness, speed and time for slicing and printing.

| PRACTICAL NO. 05 | Demonstration and 3D Printing | 04 HOURS |
|---|---|---|

1. Suitable filament material for 3D printing and selection for additive manufacturing types.
2. Demonstration of 3D printing machines, their pre-setting and filament material loading process.
3. Self-study of Bill of material (BOM).

| PRACTICAL NO. 06 | Project Presentation and Evaluation | 02 HOURS |
|---|---|---|

1. Final Presentation and demonstration of models
2. Demonstration in the video form and upload on YouTube as a digital portfolio.

**REFERENCE BOOK**


1. Chua C K, Leong K F (2010) Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific, ISBN-13: 978-981277898.
2. Noorani R (2018), Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley Sons, ISBN: 978-0-471-73001-9.
3. Liou W L (2015), Rapid Prototyping and Engineering Applications: A toolbox for prototype development, CRC Press, ISBN: 978-0849334092.
4. Kamrani A K (2012), Rapid Prototyping: Theory & practice, Springer, ISBN: 978-0-387-23291-1.
5. Kenneth Cooper (2020), Rapid Prototyping Technology: Selection and Application, Marcel Dekker, Inc. New York, ISBN: 082470261.

| MODULE: 2/4 | Civil Prototyping (CP) | 16 HOURS |
|---|---|---|
| **PRACTICAL:** | | |
| **PRACTICAL NO. 01** | **Introduction to Sustainable Materials** | **04 HOURS** |
| Introduction of Prototyping. Uses of sustainable material and its properties. Sustainable Materials- Bamboo, Timber, Recycled material, etc. 3D models and animation of products. Case studies on bamboo structures. | | |
| **PRACTICAL NO. 02** | **Design of Bamboo Joinery** | **04 HOURS** |
| Hands-on practice on different types of joinery. Fish mouth joints, lash joints, lapping joints, etc. Develop new designs of joints. | | |
| **PRACTICAL NO. 03** | **Making of Structures/Product** | **04 HOURS** |
| Making of scaled/scale-down structures/products from the selected material. Products like chairs, stools, tensegrity structure, slit techniques, road barriers, etc. | | |
| **PRACTICAL NO. 04** | **Cost Analysis for the Structure/Product** | **02 HOURS** |
| Detailed cost estimation/analysis of the structure/product. | | |
| **PRACTICAL NO. 05** | **Final Video Presentation (Evaluation)** | **02 HOURS** |
| Final Presentation and demonstration of models. Demonstration in the video form and upload on YouTube as a digital portfolio. | | |

**REFERENCE BOOK**


1. Beer & Johnston (2018), Vector Mechanics for Engineers: statics and dynamics, 10th edition, McGraw Hill Education, ISBN: 978-0073398242.
2. Chris van Uffelen (2013), Bamboo Architecture & Design (Architecture & Materials), by ISBN: 978-3037681824.
3. Jules J.A. (2015), Designing and Building with Bamboo, Janssen Technical University of Eindhoven Eindhoven, The Netherlands, ISBN 978-8186247464.

| MODULE: 3/4 | Software Prototyping (SP) | 14 HOURS |
|---|---|---|
| **PRACTICAL:** | | |
| **PRACTICAL NO. 01** | **Introduction to Software Engineering** | **02 HOURS** |
| Concepts, Software development life cycle (SDLC). Students need to use AEIOU Framework (Design Thinking) to decide the problem statement. Students will work in groups of three on the AEIOU framework | | |
| **PRACTICAL NO. 02** | **Requirement Analysis** | **02 HOURS** |
| Find the requirement specification of a given problem statement and formulate the feasible solution. | | |
| **PRACTICAL NO. 03** | **Design UML Diagrams for given Problem Statement** | **02 HOURS** |
| Project Development Canvas and then design the following, using a lucid chart tool. Creation of use case diagram, design of an activity diagram, design of Sequence diagram. | | |
| **PRACTICAL NO. 04** | **Design Analysis** | **02 HOURS** |
| Create High Fidelity Prototype using proto.io | | |
| **PRACTICAL NO. 05** | **Prototype Implementation** | **04 HOURS** |
| Web site development using tools such as HTML, JSCRIPT, Proto.io, Invision etc. | | |
| **PRACTICAL NO. 06** | **Presentation** | **02 HOURS** |
| Each group will be given 10 min to present their work | | |

**REFERENCE BOOK**


1. Roger S, Pressman (2016), Software Engineering A practitioner's Approach, 7th Edition, ISBN: 9780073375977.
2. Jonathan Arnowitz, MichaleArent (2014), Effective prototyping for software Makers, ACM Digital Library, ISBN-13:978-0120885688
3. Chua, C. K., Leong, K. F. (2010), Rapid Prototyping: Principles and applications in manufacturing, New York: Wiley, ISBN: 978-9812778987.
4. Fab - Gershenfeld, N. (2018), The coming revolution on your desktop - from personal computer to personal fabrication, New York: Basic Books. ISBN:978-0465027453.
5. Noorani, R. (2016), Rapid prototyping: Principles and applications, NJ: Wiley.ISBN: 978-0-471-73001-9.
6. Pham D. T.,Dimov S. S. (2011), Rapid manufacturing: The technologies and applications of rapid prototyping and rapid tooling, New York: Springer. ISBN: 978-1447111825.

| MODULE: 4/4 | Chemical Prototyping | 14 HOURS |
|---|---|---|
| **PRACTICAL:** | | |
| **PRACTICAL NO. 01** | **Introduction to manufacturing process** | **02 HOURS** |
| Introduction to chemical prototype and manufacturing process. Selection of manufacturing product and method. | | |
| **PRACTICAL NO. 02** | **Basic material selection** | **04 HOURS** |
| Introduction of the method and material selection. Block diagram for the process. | | |
| **PRACTICAL NO. 03** | **Manufacturing of the Product** | **06 HOURS** |
| Used unit operation and raw material for manufacturing and performance of actual experimentation | | |
| **PRACTICAL NO. 04** | **Project presentation** | **02 HOURS** |

1. Final Presentation and demonstration of models.
2. Report submission (Final Assessment and Evaluation).

List of manufacturing products:

1. Preparation of Soap
2. Preparation of Sanitizer
3. Preparation of detergent powder
4. Preparation of bio-diesel
5. Preparation of talcum powder
6. Preparation of biscuits
7. Preparation of bread
8. Preparation pen ink
9. Preparation of food color
10. Preparation of herbal hair dye
11. Preparation of herbal juice
12. Preparation of Oxalic Acid from sugar cane
13. Preparation of urea-formaldehyde resin
14. Preparation of phenol formaldehyde resin, etc.

**REFERENCE BOOK**


1. Richard A. Winter (2009), A Prototype Chemical Substances Information Network, Computer Corporation of America, Council on Environmental Quality (U.S.), Computer Corporation of America.
2. Pawel L. Urban, (2018), Prototyping Instruments for the Chemical Laboratory Using Inexpensive Electronic Modules, https://doi.org/10.1002/anie.201803878.
3. Coulson J.M, et al (1999), Chemical Engineering, Vol. 1 & 2, Butter worth Heinemann, 6th Edition, ISBN 9780080494227.
4. Foust A.S, Principles of Unit Operations (2007), John Wiley, ISBN 9780471268963.
5. Seader J.D & Henley E.J (2016), Separation Process Principles, John Wiley, 2nd Edition, ISBN 9780471586265.
6. McCabe W. L. and Smith J.C.(1993), Unit Operations in Chemical Engineering, 5th Edition, McGraw Hill Publications,ISBN 007448442.
7. Badger W. L and Banchero J.T. (2015), Introduction to Chemical Engineering, McGraw Hill Publications, ISBN 0070029954.
8. Austin G.T, Sherves (2016), Chemical Process Industries, 5th Edition, McGraw Hill, (ISBN: 9780070661677).

**ANNEXURE**

Each module will have an average of seven laboratory sessions. The students will complete two modules before the mid-semester exam and another two modules after mid-semester exam, in a rotational manner. Marks of four modules at a time will be averaged in one semester and if a student secures passing marks (passing grade) after averaging; then the required credits of the course will be earned.

**A) Course Execution:**

| **III Semester - Upto Mid-Semester Exam** | | | |
|---|---|---|---|
| **Module** | **School** | **Module** | **School** |
| 1)Mechanical Proto | Computer Engineering | 3)Computer Proto | ENTC/ETX |
| 2)Civil Proto | | 4)Chemical Proto | |

| **III Semester - After Mid-Semester Exam** | | | |
|---|---|---|---|
| **Module** | **School** | **Module** | **School** |
| 1)Mechanical Proto | ENTC/ETX | 3)Computer Proto | Computer Engineering |
| 2)Civil Proto | | 4)Chemical Proto | |

| **IV Semester - Upto Mid-Semester Exam** | | | |
|---|---|---|---|
| **Module** | **School** | **Module** | **School** |
| 1)Mechanical Proto | Civil and Chemical Engineering | 3)Computer Proto | Mechanical Engineering |
| 2)Civil Proto | | 4)Chemical Proto | |

| **IV Semester - After Mid-Semester Exam** | | | |
|---|---|---|---|
| **Module** | **School** | **Module** | **School** |
| 1)Mechanical Proto | Mechanical Engineering | 3)Computer Proto | Civil and Chemical Engineering |
| 2)Civil Proto | | 4)Chemical Proto | |

**B) Evaluation Structure:**

| **Prototyping Module** | | **Group Size** | **Demo / Presentation** (40 Marks) | | | **Continuous Activities** (35 Marks) | | **Total Marks** (75 Marks) |
|---|---|---|---|---|---|---|---|---|
| No. | Name | Student | Submission Mode | Report | PPT/ Video | Activity | Quiz | Total Activity |
| 1 | Mechanical | 5 | Report & Video/PPT | Yes | Yes | 02 | 01 | 05 |
| 2 | Civil | 5 | Report & Video | Yes | Yes | 02 | 01 | 05 |
| 3 | Computer | 5 | Presentation | Yes | Yes | 03 | 00 | 05 |
| 4 | Chemical | 5 | Report & Video/PPT | Yes | Yes | 02 | 01 | 05 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2024 - 2025 (Rev. (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | ENVIRONMENTAL SCIENCE |
| | **COURSE CODE** | 2301286 |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301286.CEO.1: To study a fundamental and ecological concept of environment.

2301286.CEO.2: To enable students to have a nuanced understanding of environmental pollution, solid waste management and climate change and to act with concern on environmental issues.

2301286.CEO.3: To develop a sense of responsibility towards society and the environment.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2301286.CO.1: Demonstrate the importance of ecosystem and biodiversity for maintaining ecological balance [L3].

2301286.CO.2: Identify different types of environmental problems and their control measures [L3].

2301286.CO.3: Apply environmental legislation and sustainable development concept [L3].

**COURSE ABSTRACT:**

This course provides an overview of the significance of ecosystems, including environmental pollution, biodiversity and its conservation, and environmental law. Discussions of environmental issues begin with climate change, global warming, and other environmental challenges. A model for the generation of Power as Solar, Wind, and Water is required for students as part of the Green Energy Corridor Project creative exercise. Students will do a brief project on any environmental idea to help them build a positive attitude towards the environment, such as the reuse, recycle, and reduce principle, environmental pollution monitoring and control, the material balance principle, sustainable development, or environmental innovations.

**THEORY**

| **UNIT 1** | **Overview of Environment: Field Study (Minimum 2)** | **06 HOURS** |
|---|---|---|

**Theory Content**: Concept of Ecology and Environmental Science, Biogeochemical cycle,Ecosystem and its management. Fate of Environmental Pollutant, Environmental status, Effect on climate change.

**Student will present in the following stages for the activities.**

- Stage I Inception (2 Hours)
- Stage II Data Collection (2 Hours)
- Stage III Analysis (2 Hours)

**Activity No: 1 (Group activity includes, only 5 members, Geo-tag photos, Detailed site visit report)**

Students have to visit any one nonhazardous polluted site for finding the various reasons of its pollution and suggest preventive measures for it.

Non Hazardous Site includes any of the following place:

- River
- Solid Waste Treatment Plant
- Garbage collection points
- Industries
- Site which comes under either of Soil, Water, Air or Industrial pollution

Visit report must content Geotag Photos and detailed site visit record. Visit can be done in a group up to 4 members only.

**Activity No: 2 (Individual activity)**

To describe the climate of an urban area by analyzing hourly variation of NCAP(National Clean Air Program) acclaimed Pollutant in the same area.

**Activity No: 3(Group activity)**

Environmental awareness programs under Swatch Bharat Mission like, Sachet Hi Sews, Swachhta pakhwada, Special Drive before Diwali, organizing essay competition, poster competition, slogan making competition, Awareness about minimum electricity consumption in campus, Celebrating various Environmental Days.

| UNIT 2 | Environmental Pollution (Minimum 3) | 08 HOURS |
|---|---|---|

**Theory Content**: Environmental Pollution: Air, Water, Soil, Solid and Hazardous Waste Management; Environment and human health, Over utilization of natural resources, Environmental Legislation, Environmental monitoring organizations in India, Environmental Protection Agency (EPA).

**Activities:**

1) Activity No. 1 Determination of PH and Electrical Conductivity of Water Sample.
2) Activity No. 2 Segregation of waste from source. (Visit to garbage segregation disposal site)
3) Activity No. 3 Measurement of noise using sound level meter.
4) Activity No. 4 Study of soil property, Temperature, Texture and Particle Size.

| UNIT 3 | Creative Exercise : Global Environmental Issues (Any One) | 08 HOURS |
|---|---|---|

**Theory Content**: Introduction to climate change, Global warming, Acid rain, Ozone layer depletion, Plastic waste management, Municipal solid waste management, Food problem, E-waste management, Social Issues: Environmental ethics and economics. (This content is for reference during practical)

**Creative Activities:**

1) The Green Energy Corridor Project Develop lab working model alternatives to renewable energy sources like solar, wind, and water for the production of power.
2) Use of social media platform for E networking and Dissemination of ideas on Environmental Issues.
3) Study of 8 National Missions on climate change as per National Action Plan on Climate Change (NAPCC), GOI.
4) Make a report on UN Goals on sustainability and also different effective measures were taken for the Conservation of Rivers in India.

| UNIT 4 | Project Work (Compulsory) | 08 HOURS |
|---|---|---|

**Project work Description:**

Students have to identify the real life environmental problems from their daily observations and try to find out the various feasible solutions for it as their project work. They are supposed to prepare the prototype, demonstration model, detailed report and present it to the evaluators. The project topic should be related to the below mentioned heads:

1) Reduce, Reuse, Recycle.
2) Environmental Pollution Monitoring and Control Material Balance Concept.
3) Sustainable Development.
4) Environmental Innovations.

The evaluation is based on at least one number of project presentation reviews apart from the final project presentation.

Participation and Certification of Student groups into Any International/National/State/Regional Level competition organized by any Government/Private Agency, NGO's, Consultancy related to Environmental Concerns.

**Rubrics for evaluation of 40 marks, of project-based learning.**

| Month Of Assessment | Assessment task | Marks |
|---|---|---|
| 1 st month | Group of 4 Members Defining objectives methodologies literature review | 10 marks |
| 2 nd month | Model development Poster making | 10 marks |
| 3 rd month | Report preparation and Plagiarism | 10 marks |
| 4 th month | Final presentation | 10 marks |

**TEXT BOOKS**


1. Rao, C. S. (2007). Environmental pollution control engineering. New Age International.
2. UNIVER ITy, R. M. B. Tech.(Full Time) Food Process Engineering Curriculum yllabus.
3. Sharma, T., Litoria, P. K., Bajwa, B. S., Kaur, I. (2021). Appraisal of groundwater quality and associated risks in Mansa district (Punjab, India). Environmental Monitoring and Assessment, 193, 1-21.
4. Unit, V. Population explosion in India, China–the present and future scenario. 9 Hours Total: 45 Hours Textbooks 1. TG Jr. Miller, Environmental Science, Wadsworth Publishing Co., 2004. B. TECH. INFORMATION TECHNOLOGY (Minimum Credits to be earned: 193) First Semester Code No.
5. Metcalf, L., Eddy, H. P., Tchobanoglous, G. (1991). Wastewater engineering: treatment, disposal, and reuse (Vol. 4). New York: McGraw-Hill.


**REFERENCE BOOKS**


1. Coronel, C., and Morris, S. (2016). Database systems: design, implementation, and management. Cengage Learning.
2. Rotabi, K. S. (2005). Theory bridging between sociology, social work and ecology. Dynamic interchanges and cross-fertilizations: The intellectual legacy of the Odum family. The University of North Carolina at Chapel Hill.
3. Peavy, H. S., Rowe, D. R., Tchobanoglous, G. (1985). Environmental engineering (Vol. 2985). New York: McGraw-Hill.
4. Nagar, S. R. M., District, K. K. Bachelor of Technology (B. Tech.) in Civil Engineering.
5. Henry, J. G., Heinke, G. W., Burton, I. (1996). Environmental science and engineering (Vol. 445, No. 452, pp. 456-457). Upper Saddle River, NJ: Prentice Hall.
6. Mayer, R. H. (2000, June). A Compendium on Environmental Engineering for Ocean Engineering Majors. In 2000 Annual Conference (pp. 5-16).

**E-RESOURCES LINKS**

1. SCIENCE DIRECT- https://www.sciencedirect.com/referencework/9780124095489/earth-systems-and-environmental-sciences
2. UNISCO- https://www.unesco.org/en/climate-changE
3. UN GOALS- https://sdgs.un.org/goals
4. NPTEL COURSE -https://archive.nptel.ac.in/courses/127/105/127105018/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2024 - 2025 (Rev. (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Project Implementation |
| | COURSE CODE | 2304292 |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | NEP 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE:** Knowledge of engineering fundamentals.

**COURSE OBJECTIVES :**

2304292.CEO.1: To develop a sense of curiosity and critical thinking approach for implementing the solutions to the real world problems.

2304292.CEO.2: To disseminate the project implementation techniques / methodological approaches to propose solution to the real world problems.

2304292.CEO.3: To cognize the ethical principles, standard engineering practices in general and its importance in project implementation, documentation and ethical writing.

2304292.CEO.4: To develop a sense of responsibility while working in a team and practice professional ethics.

2304292.CEO.5: To disseminate the importance of Intellectual property rights, writing the research articles and publication.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2304292.CO.1: Demonstrate an ability to apply discipline specific modern project management tools, techniques and resources to solve the real world project problem [L3].

2304292.CO.2: Implement feasible solutions using scientific principles and considering the socio-economic, sustainability factors for solving real world problems [L3].

2304292.CO.3: Apply the knowledge of professional ethics and standard engineering practices for project implementation, testing and documentation [L3].

2304292.CO.4: Demonstrate an ability to adhere to the professional ethics and behave responsibly as an individual and in a team and present the concepts/ prototypes/ models during theproject demonstration [L3].

2304292.CO.5: Demonstrate an ability to prepare research article, Intellectual property rights [L3].

## COURSE ABSTRACT

Field project is an avenue to cater Societal and Industrial needs. Project implementation is one of the course where students will try to solve real time engineering problems. This course focuses on Selection and application of state or art technologies/ methods/engineering tools/software/analytical techniques for comparing and providing the feasible solution. Further it emphasizes on the importance of socio-economic and sustainability factors while implementing the final solution. Through this course students learn to implement the engineering fundamental concepts, get practical experience, get the chance to showcase skills, learn about team work, communication skills and responsibilities, professional behaviour. It also imparts knowledge of standard engineering practices and Intellectual Property Rights.

**Guidelines**

Preferably project team students of Sem III would be continued in this semester IV. Every project team should consist of minimum 03 and maximum of 04 students. The team members may be from different programs to support the interdisciplinary and / or multidisciplinary functioning.

1. Team members should deliberate upon different methodical approaches and finalize the appropriate method.
2. Students project team should explore different Engineering tools/techniques for providing the problem specific solution.
3. Justify the selected method/Engineering tools/analytical techniques identified based on the feasibility, affordability and ease of use.
4. To implement the solution ,it is imperative to take inputs/suggestions from various stake holders.
5. Solution must be critically analyzed from various engineering and social aspects.
6. Completed solution must be pilot tested from the target user/stake holders.
7. Students need to protect their innovation,proof of concept through IPR.
8. While working in a team, individual student should contribute and communicate effectively to maintain team balance.
9. Learn and apply standard engineering practices and professional ethics.
10. Adherence to the principles of ethics, code of conduct and standard engineering practices is required.

**TIMELINE**

The THREE member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Presentation of Project Review -1- Phase-I : Implementation / development of the project. 3 Weeks (1st -3rd week)
2. Presentation of Project Review -2 - Phase -II : Project implementation and testing.: 3 weeks (4rd- 6th week)
3. IPR Activity on earlier selected project problem : 2 Weeks (7th-8th week)
4. Preparation of Project Progress Report (week 9th and 10th)
5. Project Documentation ( 11th week) (Assessment by project Guide)
6. Submission of the final project copy to the project guide. ( 12th week)
7. Evaluation by external examiner ( End Semester by 13th, 14th week)

**Project Demonstration (50 Marks)**

1. **Review 1 (Project Implementation) (05 marks)**
   - Use appropriate procedures, modern tools and techniques to conduct experiments and collect data, represent in tabular/ graphical form and draw valid conclusions.
   - Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem and Verify the credibility of results.
2. **Review 2 (Project Demonstration) (10 marks)**
   - Demonstrate proficiency in using discipline specific modern tools/ techniques to solve the project problem.
   - Demonstrate an ability to describe engineering roles in a broader context, pertaining to the environment, safety, public welfare.
3. **Project Activities (05 Marks)**
   - Demonstrate an ability to prepare and publish research article.
   - Demonstrate an ability to write a Patent Draft, file IPR.
4. **Project Documentation (10 marks)**
   - Produce clear, well-constructed, and well-supported written engineering documents, project cost sheet and plagiarism report.
5. **Final project demonstration & Project team presentation (20 marks)**
   - Demonstrate effective communication,Implement the norms of standard professional practices, Present results as a team showing the responsible behaviour.

**TEXT BOOKS**


1. Schmidt, T. (2009). Strategic Project Management Made Simple. 2nd Edition, Wiley Pub, India.ISBN 978-1-119-71817-8
2. Challender, J. (2022). Professional Ethics in Construction and Engineering", Wiley .ISBN-13: 978-1-119-83210-2
3. Rogerson, S. (2003). Computer Ethics and Professional Responsibility. 1st Edition Wiley Blackwell Publication.ISBN-13: 978-1855548459
4. Nagarazan, R.S. (2022). A Textbook on Professional Ethics and Human Values. New Age Publication, ISBN-13: 978-81-224-2301-3
5. Hering, L. and Hering H. (2005). How to write Technical Reports. Springer ISBN : 978-3-540-69929-3
6. Tewari, R. and Bhardwaj, M. (2021).Intellectual Property A Primer for Academia. Publication Bureau, Panjab University Chandigarh ISBN: 81-85322-92-9

## REFERENCE BOOKS


1. Zwikael, O. and Smyrk, J. (2019). Project Management A Benefit Realization Approach. Springer Publication, ISBN-13: 978- 0134877693
2. Handley, W. (1977). Industrial Safety Handbook. 2nd Revised edition ,McGraw-Hill Companies;, ISBN-13: 978-0070844810
3. Mislick, G. and Mussbaum, D. (2015) Cost Estimation: Methods and Tools. Wiley, ISBN-13: 978-1-118-53613-1
4. Chilcutt, A. and Adam, J. (2019). Engineered to Speak: Helping You to Create and Deliver Engaging Technical Presentations. Wiley, ISBN-13: 978-1-119-47496-8


## E-RESOURCES

1. University of California, free online course: https://www.classcentral.com/course/project-planning-1-12208
2. International Journal of Project Management : https://www.sciencedirect.com/journal/international-journal-of-project-management
3. Procedia- Social and Behavioral Sciences Open access journal: https://www.sciencedirect.com/journal/procedia-social-and-behavioral-sciences
4. Free software tool for project Management : https://onlinepmcourses.com/project-management-tools/free-project-management-resources/
5. Research Article:https://doi.org/10.1016/j.sbspro.2012.12.210
6. Research Article: https://doi.org/10.1016/j.tsc.2024.101477
7. Research Article: https://doi.org/10.1016/j.ijproman.2024.102584

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2024 - 2025 (Rev. (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Internship (Life andSoft Skills) |
| | COURSE CODE | 2304296L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | NIL | 75 | 75 |

**PRE-REQUISITE :** Knowledge about the communication skills

**COURSE OBJECTIVES :**

2304296L.CEO.1: To enhance technical skills and self-directed learning.

2304296L.CEO.2: Todevelop adaptability and resilience in a multicultural or professional environment.

2304296L.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2304296L.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2304296L.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304296L.CO.1: Utilize online learning platforms effectively to acquire technical skills and engage in lifelong learning [L3].

2304296L.CO.2: Apply professional behavioral practices, including teamwork, time management, and ethical decision-making, in diverse settings [L3].

2304296L.CO.3: Evaluate personal growth and adaptability gained through experiential learning and real-life experiences [L4].

2304296L.CO.4: Evaluate personal growth and adaptability gained through experiential learning and real-life experiences [L4].

2304296L.CO.5: Formulate well-defined problem statements by critically examining real-world challenges and exploring innovative approaches [L4].

2304296L.CO.6: Demonstrate effective communication skills by preparing and delivering professional presentations and writing clear, concise reports [L5].

**INTRODUCTION:**

This internship is designed to equip second-year entrants B.Tech. students with essential skills for personal and professional growth. The program focuses on cultivating professionalism and life skills, enabling students to enhance their technical and soft skills in today's competitive landscape. Through this experience, students will develop a comprehensive skill set, including emotional intelligence, effective communication, teamwork, and sportsmanship. Additionally, the course encourages active participation in co-curricular and extracurricular activities, fostering resilience, adaptability, and a collaborative spirit. By completing this internship, students will establish a solid foundation for academic success and career readiness.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Life and Soft Skills is designed for students entering the second year of the B.Tech. program, to be undertaken during the summer break after Semester II. This program aims to provide opportunities for skill enhancement through life skills development, technical skills training, or industrial exposure. The internship focuses on helping students identify and engage with relevant learning platforms, small-scale industries, or training opportunities to build competencies essential for personal and professional growth. The program emphasizes cultivating life skills, such as effective communication, teamwork, emotional intelligence, and adaptability, alongside fostering technical expertise.

**Structure**

- **Duration:** : 3 to 4 weeks (minimum of 100 hours).
- **Timeframe:** Conducted during June-July of each academic year.
- **Nature of Internship:**

1. Life skills development courses.
2. Technical skills training programs.
3. Industrial training with companies or small-scale industries.

- **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.
- **Mentorship:** Each first-year student will be assigned their first-year mentor as their internship guide. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development.

**Student Development Focus :**

Before selecting an internship option, students are required to identify specific areas of self-development they wish to enhance. This may include life skills (e.g., communication, leadership, emotional intelligence), technical competencies, or professional abilities.

Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

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**1. Continuous Assessment (CA): Biweekly Progress Reports and interaction with faculty mentor (40%):**

Students must submit at least two progress reports during the internship/training period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them
- Reports will be evaluated by the assigned first-year faculty mentor based on content quality, reflection, and consistency.

**2. Detailed Project Report with Learning Outcomes (30%)**

Upon completion of the internship, students are required to submit a comprehensive minimum of 20 to 25 pages' internship/project report. The report must include:

1. Overview of training activities
2. Skills and knowledge acquired (technical/soft/life)
3. Specific challenges addressed
4. Personal and professional growth reflections
5. Clearly stated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certiftcate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2024 - 2025 (Rev. (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Indian Constitution |
| | **COURSE CODE** | 2301281A |
| | **COURSE CREDITS** | (Audit Course) |
| **RELEASE DATE :** | **REVISION NO** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | NIL | NIL | NIL | NIL | NIL | NIL | NIL |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301281A.CEO.1: To realise the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.
2301281A.CEO.2: To identify the importance of fundamental rights as well as fundamental duties.
2301281A.CEO.3: To understand the functioning of Union, State and Local Governments in Indian federal system
2301281A.CEO.4: To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301281A.CO.1: Explain the significance of Indian Constitution as the fundamental law of the land [L2].
2301281A.CO.2: Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building [L2].
2301281A.CO.3: Analyze the Indian political system, the powers and functions of the Union, State and Local Governments in detail [L3].
2301281A.CO.4: Explain Electoral Process, Emergency provisions and Amendment procedure [L2].

## COURSE ABSTRACT

Indian constitution is an audit course designed for the all FY. BTech students. Indian constitution is a great source of human values promoting through its legislative, executive and judiciary institutions. The key values that are learnt from constitution are justice, liberty, equality and fraternity. Constitution also teaches us to be impartial, non-partisan and tolerant in our attitude and public interactions. Liberty of thought, expression, belief or faith is necessary for all round development of an individual which the constitution teach and protects. It also inculcates the value of fraternity that promotes the spirit of common brotherhood among all citizens.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Indian Constitution** | **3 HOURS** |

Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India, Salient features and characteristics of the Constitution of India, Scheme of the fundamental rights, The scheme of the Fundamental Duties and its legal status, The Directive Principles of State Policy – Its importance and implementation.

| | | |
|---|---|---|
| **UNIT 2** | **Federal Structure and Amendment** | **5 HOURS** |

Federal structure and distribution of legislative and financial powers, between the Union and the States, Parliamentary Form of Government in India – The constitution powers and status of the President of India, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India.

| | | |
|---|---|---|
| **UNIT 3** | **Emergency Provisions** | **2 HOURS** |

Emergency Provisions: National Emergency, President Rule, Financial Emergency.

| | | |
|---|---|---|
| **UNIT 4** | **Constitutional Schemes** | **5 HOURS** |

Local Self Government – Constitutional Scheme in India, 13. Scheme of the Fundamental Right to Equality, Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and Personal Liberty under Article 21.

## TEXT BOOKS


1. Basu, D. D., Manohar, V. R., Banerjee, B. P., & Khan, S. A. (2015). Introduction to the Constitution of India (pp. 87-9). Gurgaon: LexisNexis..
2. Austin, G. (1966). The Constitution of India: Cornerstone of a Nation.


## REFERENCE BOOKS


1. Bakshi, P. M., & Kashyap, S. C. (1982). The constitution of India. Universal Law Publishing.
2. Pylee, M. V. (2003). Constitutional government in India. S. Chand Publishing.


## E-RESOURCES (NPTEL Courses)

1. Constitutional Studies - Course (nptel.ac.in)

MIT | Academy of Engineering

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## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for
# Third Year
# Bachelor of Technology
# Computer Engineering

## NEP REVISION

(With Effect from Academic Year: )

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| THIRD YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: V (COMPUTER ENGINEERING)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT/TUT | | TOTAL | |
| | | | L | P | T | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304311T | Operating Systems | 3 | - | - | 20 | 30 | 50 | - | - | 100 | 3 |
| | 2304311L | Operating Systems Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2304312T | Computer Networks | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304312L | Computer Networks Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PEC | 2304321T | Exploratory Data Analytics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304322T | Artificial Intelligence Machine Learning | | | | | | | | | | |
| | 2304323T | Cloud Computing Foundation | | | | | | | | | | |
| | 2304324T | Cryptography and Information Security | | | | | | | | | | |
| | 2304321L | Exploratory Data Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2304322L | Artificial Intelligence Machine Learning Lab | | | | | | | | | | |
| | 2304323L | Cloud Computing Foundation Lab | | | | | | | | | | |
| | 2304324L | Cryptography and Information Security Lab | | | | | | | | | | |
| VSEC | 2304361L | Linux Administration-I | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2304362L | Web Technology | | | | | | | | | | |
| | 2304363L | Mobile Application Development | | | | | | | | | | |
| | 2304364L | UI/UX Design | | | | | | | | | | |
| MDM | *MDM List | Multi Disciplinary Minor Course-II | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | *MDM List | Multi Disciplinary Minor Course-II Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ELC PRJ | 2304391L | Major Project - I | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2304396L | Summer Internship (Technical) | - | - | - | - | - | - | - | 75 | 75 | 2 |
| **TOTAL** | | | **11** | **16** | **-** | | | | | | **800** | **21** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| THIRD YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: VI (COMPUTER ENGINEERING)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | CREDIT |
| | | | L | P | T | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304313T | Software Engineering | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304313L | Software Engineering Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2304314T | Design & Analysis of Algorithms | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304314L | Design & Analysis of Algorithms Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PEC | 2304326T | Predictive Analytics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304327T | Deep Learning | | | | | | | | | | |
| | 2304328T | Cloud Native Application Development | | | | | | | | | | |
| | 2304329T | Cyber Security & Forensics | | | | | | | | | | |
| | 2304326L | Predictive Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2304327L | Deep Learning Lab | | | | | | | | | | |
| | 2304328L | Cloud Native Application Development Lab | | | | | | | | | | |
| | 2304329L | Cyber Security & Forensics Lab | | | | | | | | | | |
| VSEC | 2304366L | Linux Administration-II | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2304367L | Cloud Services | | | | | | | | | | |
| | 2304368L | Practioner's Approach to AI | | | | | | | | | | |
| | 2304369L | Web and Desktop Application Development | | | | | | | | | | |
| MDM | *MDM List | Multi Disciplinary Minor Course-III | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | *MDM List | Multi Disciplinary Minor Course-III Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| HSSM AEC | 2301371L | Employability and Career Development | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC PRJ | 2304392L | Major Project - II | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| **TOTAL** | | | **11** | **20** | **-** | | | | | | **800** | **21** |

*Four Credit Internship needs to be completed after Completion of the Third Year

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | OPERATING SYSTEMS |
| | **COURSE CODE** | 2304311T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Data Structures

**COURSE OBJECTIVES :**

2304311T.CEO.1: To impart knowledge of key operating system concepts and its services
2304311T.CEO.2: To provide comprehensive understanding of the concepts related to process, Inter process communication (IPC), scheduling and deadlock management
2304311T.CEO.3: To discuss memory management schemes in operating system
2304311T.CEO.4: To familiarize file management and protection aspects of Operating system

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304311T.CO.1: Identify the role of OS in the management of system resources [L3]
2304311T.CO.2: Build concurrent solutions using synchronization mechanisms and multi-threading [L3]
2304311T.CO.3: Analyze advanced deadlock prevention and avoidance techniques [L4]
2304311T.CO.4: Examine memory allocation policies and memory protection mechanisms [L4]
2304311T.CO.5: Inspect security measures across file systems in operating systems [L3]

**COURSE ABSTRACT:**

Operating systems play a crucial role in the field of computer engineering. It acts as a bridge between hardware and software, managing the resources of a computer system such as memory, CPU, storage, and input/output devices. Operating systems enable multitasking, allowing multiple programs to run concurrently and efficiently share system resources. Additionally, operating systems provide essential services such as file management, security mechanisms, device drivers, and network communication protocols, ensuring the smooth and secure operation of computer systems. Overall, operating systems are foundational components in computer engineering, facilitating software development, resource management, multitasking, and system stability.

**THEORY COURSE CONTENT**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Operating System** | **5 HOURS** |

**App/System/Case study:** Open Source Operating System-Linux

**Contents:**

Operating System Overview, Functions, Types of OS- Batch, Timesharing, Multiprogramming, Multitasking ,Distributed,Network and Realtime (RTOS), OS Structure-monolithic,micro,hybrid, System Calls,System Boot,Unix Architecture

**Self -Study:** Virtual Machines, Dual Mode Operation.

**Further Reading:** Use of OS in various computing environments

| | | |
|---|---|---|
| **UNIT 2** | **Process Management** | **8 HOURS** |

**App/System/Case study:** Process Management in Online Transaction Processing Systems

**Contents:** Process Concept, Process Scheduling-Scheduling Queues, Schedulers, Context Switch, Operations on processes, Inter process Communication-Shared Memory, Message Passing Systems, Pipes, Inodes, Process State Transition in Unix (9 states)

**Self-Study:** Communication in Client-Server Systems

**Further Reading:** Operating System Debugging

| | | |
|---|---|---|
| **UNIT 3** | **Multithread Programming and CPU Scheduling** | **8 HOURS** |

**App/System/Case study:** Multithreading in Web Servers

**Contents:** Thread Overview, Multicore Programming, Multithreading Models, Thread Libraries Threading issues. Basic Concepts of CPU scheduling, Scheduling criteria, Scheduling Algorithms-FCFS, SJF, Priority and Round Robin

**Self-study:** Thread creation in Linux

**Further Reading:** Scheduling Algorithms in RTOS

| | | |
|---|---|---|
| **UNIT 4** | **Process Synchronization and Deadlock** | **8 HOURS** |

**App/System/Case study:** Distributed Deadlocks

**Contents:** Process Synchronization overview, The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic problems of synchronization, Deadlock, Methods for Handling Deadlocks,Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery

**Self- Study:** Synchronization in graphics and multimedia processing

**Further Reading:** Techniques for testing and debugging concurrent programs

| UNIT 5 | Memory Management | 8 HOURS |
|---|---|---|

**App/System/Case study:** ARM architecture

**Contents:** Main memory-Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of page table, Virtual Memory-Demand Paging, Page Replacement Policies: FIFO, LRU, Optimal, Allocation of Frames, Thrashing

**Self- Study:** Linux memory management schemes

**Further Reading:** Memory Management in xv6

| UNIT 6 | File Management and System Protection | 8 HOURS |
|---|---|---|

**App/System/Case study:** Linux File System.

**Contents:** File-System structure, File-System Implementation, Directory Implementation, Allocation Methods, Internal Representation of files in UNIX through Inodes, System Protection:Goals,Principles,Domain,Access Matrix,Access Control,Revocation of Access Rights

**Self- Study:** Domain in UNIX and MULTICS

**Further Reading:** WAFL File System

## TEXT BOOKS


1. Silberschatz, A., Galvin, P. B., Gagne, G. (2018). Operating system concepts. Wiley. ISBN : 1119439256
2. Bach, M. J. (1986). The design of the UNIX operating system. Prentice/Hall. ISBN : 0132017571


## REFERENCE BOOKS


1. Stallings, W. (2018). Operating systems : internals and design principles. Pearson. ISBN-13: 9780137516742
2. Deitel, H. M., Deitel, P. J., Choffnes, D. R. (2004). Operating Systems. Prentice Hall. ISBN-13:978-0131828278


## E-RESOURCES


1. Ritchie, D. M., Thompson, K. (1983). The UNIX time-sharing system. Communications of the ACM, 26(1), 84–89. https://doi.org/10.1145/357980.358014

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | OPERATING SYSTEMS LAB |
| | **COURSE CODE** | 2304311L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Requires knowledge of Data Structures

**COURSE OBJECTIVES :**

2304311L.CEO.1: To explain the basic concepts of shell programming.
2304311L.CEO.2: To make familiar the programming concepts for interprocess communication and memory management.
2304311L.CEO.3: To emphasize on implementation aspect of CPU Scheduling Algorithms.
2304311L.CEO.4: To get acquainted with different problems of synchronization.
2304311L.CEO.5: To describe various methods of handling deadlocks in operating systems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304311L.CO.1: Apply shell scripting and system calls to create efficient process-based solutions, including inter process communication (IPC) techniques[L3].
2304311L.CO.2: Demonstrate the ability to manage system resources through scheduling techniques and analyze their impact on overall system performance. [L3].
2304311L.CO.3: Analyze and compare page replacement algorithms to ensure effective virtual memory management[L4].
2304311L.CO.4: Build secure and concurrent systems using synchronization mechanisms, multi-threading techniques, and controlled file system access[L5].

**COURSE ABSTRACT:**

The operating system laboratory holds significant importance in computer engineering education and research. Laboratory exercises reinforce theoretical concepts learned in operating system courses, such as process management, memory management, file systems, and concurrency control.Comparison of the performances of various scheduling algorithms, memory allocation strategies, and file system designs is explored . Thus operating system laboratory is a crucial component of computer engineering education, offering practical learning opportunities, skill development, and preparation for professional roles in the IT industry. It bridges the gap between theory and practice, equipping students with the expertise needed to tackle complex system challenges and innovate in the field of operating systems and software development.

| PRACTICALS Perform following experiments using Open source tools | | |
|---|---|---|
| **PRACTICAL NO.01** | **Write shell script to display disk space usage of the ftle system, including the total space, used space, available space, and usage percentage** | **6 HOURS** |
| Further practice: 1. Write a shell script that implements various file and directory related commands.<br>2. Write a shell script that checks and sets file system permissions for files and directories based on specified criteria, such as ownership and read/write/execute permissions. | | |
| **PRACTICAL NO.02** | **Develop a program to demonstrate process creation, termination, and communication using PIPE as an IPC (Interprocess Communication) mechanism.** | **4 HOURS** |
| Further practice: 1. Implement Interprocess Communication using Shared Memory.<br>2. Implement Interprocess Communication using Message Passing | | |
| **PRACTICAL NO.03** | **Implement a simple process scheduler using scheduling algorithms such as FCFS (First-Come, First-Served), SJF (Shortest Job First), and RR (Round Robin).** | **4 HOURS** |
| Further practice: Implement a simple process scheduler using non preemptive scheduling algorithms like SJF (Shortest Job First) and Priority scheduling algorithm.<br>Implement a simple process scheduler using preemptive Priority scheduling algorithm. | | |
| **PRACTICAL NO.04** | **Implement synchronization mechanisms such as semaphores, mutexes, and condition variables to solve synchronization problems for any suitable multithreaded application.** | **4 HOURS** |
| Further practice: Develop a thread pool manager that maintains a pool of worker threads for executing tasks concurrently. Use semaphores or mutexes to manage thread creation, task assignment, and synchronization between the main thread and worker threads. | | |
| **PRACTICAL NO.05** | **In a real computer system, neither the resources available nor the demands of processes for resources are consistent over long periods (months). Resources break or are replaced, new processes come and go, and new resources are bought and added to the system. If deadlock is controlled by the banker's algorithm, which of the following changes can be made safely (without introducing the possibility of deadlock), and under what circumstances? a. Increase Available (new resources added). b. Decrease Available (resource permanently removed from system).** | **4 HOURS** |
| Further practice: Design and implement a deadlock prevention scheme that imposes resource ordering to ensure that the system never enters a deadlock state. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.06** | **Implement a virtual memory system with features like demand paging, page replacement algorithms (e.g., FIFO, LRU,Optimal), and handling page faults.** | **2 HOURS** |
| Further practice: Implement best fit ,worst fit and worst fit algorithms for memory allocation. | | |
| **PRACTICAL NO.07** | **Design and implement a simple ftle system with basic operations like ftle creation, deletion, reading, and writing using data structures like inodes and ftle allocation tables.** | **6 HOURS** |
| Further practice: Implement Role-Based Access Control (RBAC) concepts in operating system | | |

## TEXT BOOKS


1. Nemeth, E., Snyder, G., Hein, T. R., Whaley, B., Mackin, D. (2017). UNIX and Linux System Administration Handbook. Addison-Wesley Professional. ISBN-13 978-0134277554
2. Das, S. (2017). Unix Concepts And Applications.Mcgraw-Hill. ISBN 978-0070635463
3. Williams, A. (2019). C++ Concurrency in Action. Simon and Schuster.ISBN : 9781638356356
4. Stevens, W., Rago, S. (2013). Advanced Programming in the UNIX Environment. Pearson Education, Limited.


## REFERENCE BOOKS


1. Shotts, W. E. (2019). The Linux Command Line, 2nd Edition: A Complete Introduction. No Starch.
2. Robbins, K. A., Robbins, S. (2015). UNIX systems programming : communication, concurrency, and threads. Prentice Hall. ISBN: 978-0134424071


## E-RESOURCES


1. Ritchie, D. M., Thompson, K. (1983). The UNIX time-sharing system. Communications of the ACM, 26(1), 84–89. https://doi.org/10.1145/357980.358014

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | COMPUTER NETWORKS |
| | COURSE CODE | 2304312T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Data Structure, Discrete Structures and Graph Theory

**COURSE OBJECTIVES :**

2304312T.CEO.1: To build understanding of fundamental concepts of data communication and networking.
2304312T.CEO.2: To differentiate between network types typologies.
2304312T.CEO.3: To explore routing algorithms applications in various scenarios.
2304312T.CEO.4: To classify connection oriented and connection-less services.
2304312T.CEO.5: To explore current trends in networking technologies.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304312T.CO.1: Utilize signals and communications types with respect to network infrastructure. [L3]
2304312T.CO.2: Build different types of network topologies and protocols. [L3]
2304312T.CO.3: Evaluate routing protocols for different real time systems.[L5]
2304312T.CO.4: Analyze connection oriented and connectionless services.[L4]
2304312T.CO.5: Demonstrate different application/systems related to networking.[L3]

**COURSE ABSTRACT:**

A computer network is a set of computers connected together for the purpose of sharing resources. The most common resource shared today is connection to the Internet. Other shared resources can include a printer or a file server.

This course deals with fundamentals of computer network. It deals with various network models, types and OSI layers. This course provides uses of computer network, role of seven OSI layers for wire oriented and wireless communication.

At the end of the course, the students will be able to build an understanding of the fundamental concepts of computer computer networks, networking concepts, network standards protocols, fundamental network security etc.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Physical Layer** | **09 HOURS** |

**Applications/Case Study:** E-Mail System, Digital Speedometer, Multiuser Network Games

**Contents:** Data Communications, Networks, Network Types: LAN,MAN, WAN, Wireless mesh network, Hybrid wireless networks Protocol Layering, The OSI Model, TCP/IP Protocol Suite, Data and Signals, Periodic analog signals, Digital Signals, Transmission Impairments, Data rate limits, Performance, Line Coding , Line Coding Schemes : Unipolar, Polar, Bipolar

**Self Study:** Standards And Administration

**Further Readings:** Transmission Modes.

| | | |
|---|---|---|
| **UNIT 2** | **Data Link Layer** | **09 HOURS** |

**Applications/Case Study:** WinRAR, WinZip

**Contents:**Introduction: Nodes and Links, Services, Two categories of links, Two sublayers , Link Layer addressing: Three types of addresses, Address Resolution Protocol(ARP), Error detection and correction: Types of errors, redundancy, Detection Vs Correction, Coding, Block Coding: Hamming codes ,Cyclic Redundancy Check, Data Link Control and Services: Framing, Flow Control, Connectionless and Connection-Oriented, Data Link Layer Protocols : Simplest Protocol, Stop and Wait Protocol , Piggybacking , Stop-and-Wait ARQ ,Sliding Window Protocols: GO-Back-N ARQ, Selective-Repeat ARQ, Random Access: CSMA,CSMA/CD,CSMA/CA, Media access protocol for Wireless LAN

**Self Study:** Standard Ethernet

**Further Readings:** Wi-Max(IEEE Project 802.16).

| UNIT 3 | Network Layer | 09 HOURS |
|---|---|---|
| **Applications/Case Study:** Team viewer, Windows Remote Desktop Connection<br>**Contents:** Introduction, Network Layer Services: Packetizing, Routing and Forwarding, Other Services, Packet Switching: Datagram Approach: Connectionless Service, Virtual-Circuit Approach: Connection-Oriented Service, Network-layer Performance: Delay, Throughput, Packet loss, IPv4 Addresses: Address Space, Classful addressing, Classless Addressing, Dynamic Host Configuration Protocol(DHCP), Network Address Translation(NAT), Internet Protocol(IP) , Internet Control Message Protocol(ICMPv4), Routing Algorithms: Distance-Vector Routing, Link-State Routing, Path-Vector Routing, Wireless routing protocol, Ad-hoc on demand Distance vector RP,<br>**Self Study:** Multicast Routing(tree based multicasting and Zone based multicasting)<br>**Further Readings:**Internet Group Message Protocol(IGMP). | | |
| **UNIT 4** | **Transport Layer** | **06 HOURS** |
| **Applications/Case Study:** Microsoft Team, Cisco Webex, Google Hangout<br>**Contents:** Introduction: Transport Layer Services, Connectionless and Connection-Oriented Protocols, Transport-Layer Protocols: Services, Port Numbers, User Datagram Protocol(UDP): Datagram, Services, Applications, Transmission Control Protocol(TCP): Services, Features, Segment, Connection, Applications, Socket Programming, Ad-hoc TCP<br>**Self Study:** Application Controlled Transport Protocol (ACTP)<br>**Further Readings:**Real Time Transport Protocol (RTP) | | |
| **UNIT 5** | **Application Layer** | **06 HOURS** |
| **Applications/Case Study:** Moodle Server, FileZilla, IP messenger, WhatsApp<br>**Contents:** Introduction: Providing Services, Application-Layer Paradigms, Domain Name System (DNS), Hypertext Transfer Protocol (HTTP), Simple Mail Transfer Protocol (SMTP), File Transfer Protocol (FTP).<br>**Self Study:** Simple Network Management Protocol (SNMP)<br>**Further Readings:** TerminaL Network(TELNET),Secure Shell(SSH) | | |
| **UNIT 6** | **Networking Trends** | **06 HOURS** |
| **Applications/Case Study:** VOIP, IoT<br>**Contents:** Introduction, Software Defined Networking(SDN): Concept, Architecture, Communication, Application, Network Security: Policy - Integrity , Confidentiality, Availability , Privacy, Overview Data Centric Networks, Secure routing in Ad-Hoc network: Requirements and Security aware Ad Hoc Routing protocol<br>**Self Study:** SD-WAN<br>**Further Readings:** Platform for Privacy Preferences(P3P). | | |

## TEXT BOOKS


1. Behrouz A. Forouzan, (2022) ”Data Communications and Networking”, 6th edition, Tata McGraw-Hill Publications, 2013
2. Doulas E. Comer, (2016) ”Computer Networks and Internets, 6th edition, Pearson Education Limited, ISBN 978-1292061177
3. C. Siva Ram Murthy, (2017) ” Ad-HoC Wireless Networks”, Pearson Publication, 26th impression,


## REFERENCE BOOKS


1. . Andrew S. Tanenbaum, David J. Wetherall, (2022) ”Computer Networks”, 5thedition, Pearson Education India, ISBN 978-9332518742.
2. Larry L. Peterson Bruce S. Davie, (2011) “Computer Networks”, 4th edition, Morgan Kaufmann Publisher, ISBN 978-0-12-370548-8
3. William Stallings, (2020) ”Data and Computer Communications”, 9thedition, Pearson Education India, 2013, ISBN 978-9332518865
4. 4. Behrouz A. Forouzan, (2013) ”Data Communications and Networking”,5th edition, Tata McGraw-Hill Publications, ISBN 978-0-07-296775-3


## E-RESOURCES

1. https://nptel.ac.in/courses/106106091

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | COMPUTER NETWORKS LAB |
| | COURSE CODE | 2304312L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Data Structure, Discrete Structures and Graph Theory

**COURSE OBJECTIVES :**

2304312L.CEO.1: To build understanding of fundamental concepts of data communication and networking.
2304312L.CEO.2: To differentiate between network types typologies.
2304312L.CEO.3: To explore routing algorithms applications in various scenarios.
2304312L.CEO.4: To classify connection oriented and connection-less services.
2304312L.CEO.5: To explore current trends in networking technologies.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304312L.CO.1: Make use of modern simulation tools to implement scenarios. [L3]
2304312L.CO.2: Evaluate routing protocols for different real time systems.[L5]
2304312L.CO.3: Analyze connection oriented and connectionless services.[L4]

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **.** | **2 HOURS** |
| Setup a wired LAN using Layer 2 Switch and then IP switch of minimum four computers. It includes preparation of cable, testing of cable using line tester, configuration of machine using IP addresses, testing using PING utility and demonstrate the PING packets captured traces using Wireshark Packet Analyzer Tool. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Using Cisco Packet tracer design and test the a. Different network topologies b. Subnet | | |
| **PRACTICAL NO.03** | **.** | **4 HOURS** |
| Write a program to detect and correct single bit error using a. Parity Check b. Cyclic Redundancy Check and c. Hamming code | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Write a program to implement sliding window mechanism using a. Stop and Wait ARQ b. Go Back N ARQ c. Selective Repeat ARQ | | |
| **PRACTICAL NO.05** | | **4 HOURS** |
| Write a program to implement subnet calculator. | | |
| **PRACTICAL NO.06** | | **2 HOURS** |
| Write a program to implement Distance Vector Routing / Link State Routing. | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Write a program to implement simple communication between Client-Server using sockets utility (TCP and UDP) and demonstrate the packets captured traces using Wireshark Packet Analyzer Tool. | | |
| **PRACTICAL NO.08** | **Mini Project** | **06 HOURS** |
| Mini Project Guide Lines Maximum 3 students allowed in each group. Each group will work on design and Implementation. Students should submit the report in soft copy and hard copy. | | |

## TEXT BOOKS


1. Behrouz A. Forouzan, (2022) ”Data Communications and Networking”, 6th edition, Tata McGraw-Hill Publications, 2013
2. Doulas E. Comer, (2016) ”Computer Networks and Internets, 6th edition, Pearson Education Limited, ISBN 978-1292061177
3. C. Siva Ram Murthy, (2017) ” Ad-HoC Wireless Networks”, Pearson Publication, 26th impression,


## REFERENCE BOOKS


1. . Andrew S. Tanenbaum, David J. Wetherall, (2022) ”Computer Networks”, 5thedition, Pearson Education India, ISBN 978-9332518742.
2. Larry L. Peterson Bruce S. Davie, (2011) “Computer Networks”, 4th edition, Morgan Kaufmann Publisher, ISBN 978-0-12-370548-8
3. William Stallings, (2020) ”Data and Computer Communications”, 9thedition, Pearson Education India, 2013, ISBN 978-9332518865
4. 4. Behrouz A. Forouzan, (2013) ”Data Communications and Networking”,5th edition, Tata McGraw-Hill Publications, ISBN 978-0-07-296775-3


## E-RESOURCES

1. https://nptel.ac.in/courses/106106091

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | EXPLORATORY DATA ANALYTICS |
| | **COURSE CODE** | 2304321T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Essential of Data Science, Applied Mathematics

**COURSE OBJECTIVES :**

2304321T.CEO.1: To understand the data warehouse architecture.
2304321T.CEO.2: To apply the various operations on OLAP cubes.
2304321T.CEO.3: To outline the various preprocessing operations on data warehouses.
2304321T.CEO.4: To explain the different hypothetical Tests.
2304321T.CEO.5: To apply the different association algorithms
2304321T.CEO.6: To implement decision tree based classification techniques

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304321T.CO.1: Select the efficient data warehouse architecture for the given case study.[L3]
2304321T.CO.2: Develop a data mart using different modeling techniques for given applications and present it in a group.[L3]
2304321T.CO.3: Analyze the prediction by hypothesis testing using data analysis tools.[L4]
2304321T.CO.4: Construct a model for providing predictions on given datasets by identifying trends, detecting outliers on real-time application using available tools and technology.[L4]

**COURSE ABSTRACT:**

Exploratory Data Analytics is the first course under Data Science track. Exploratory Data Analytics is a foundational course designed to equip students with the essential skills and knowledge necessary to extractactionable insights from data. This course provides a comprehensive overview of various techniques andmethodologies utilized in descriptive analytics, focusing on data preprocessing, analysis, and interpreta-tion. Students will learn how to leverage data warehouses, perform data wrangling, conduct hypothesistesting, and utilize various analytical models to gain valuable insights from data.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION TO DATA WAREHOUSE** | **08 HOURS** |

**Applications/Case Study:** Retail-Industry Case Study

**Contents:** Introduction to Data Science and Data Mining, Descriptive, Predictive and Prescriptive Data Analysis Techniques.

Introduction to Data Warehouse, DW Architecture, DW Characteristics, ETL, Introduction to Business Intelligence. Applications of BI. Distributed Data Warehouse, Real Time Data Warehouse Architecture. Data lakes

**Self Study:** Data Warehouse Security Measures: User access, Data load, Data movement, Query generation

**Further Readings:** Advancement Data Collection Security

| | | |
|---|---|---|
| **UNIT 2** | **ONLINE ANALYTICAL PROCESSING** | **06 HOURS** |

**Applications/Case Study:** Retail-Industry Case Study

**Contents:** Online Analytical Processing, difference between Online Transaction processing, types of OLAP techniques, survey of several OLAP techniques. Making cubes, performing Cube operations-Roll up, Drill down, slice, dice and pivot, OLAP Queries, Data Cube Computations.

**Self Study:** Data visualization techniques

**Further Readings:** Cubing Service Security, Multidimensional Data Analysis.

| | | |
|---|---|---|
| **UNIT 3** | **DATA WRANGLING AND HYPOTHESIS TESTING** | **09 HOURS** |

**Applications/Case Study:** Retail-Industry Case Study

**Contents:** Concept of Data wrangling and various techniques of data wrangling, case study on data wrangling, Descriptive Statistics. Null Hypothesis, Alternative Hypothesis, Type-I and Type-II Error, Inferential Statistics through Hypothesis Tests, Z-Test, T-Test, Chi Square Test, ANOVA, F Test

**Self Study:** Probability distributions

**Further Readings:** Randomization Test

| UNIT 4 | REGRESSION AND CORRELATION | 08 HOURS |
|---|---|---|
| **Applications/Case Study:** Real Estate Case Study<br>**Contents:** Concept of regression, overfitting, under fitting, bias, variance. Gradient Descent. Simple Regression, Multiple Regression, Linear-Logistic Regression, Poisson Regression, Non-Linear Regression. Correlation Coefficient, Measuring Performance of a Model, Accuracy, ROC Curves, Precision-Recall Curves.<br>**Self Study:** Regression Models using Excel 2013<br>**Further Readings:** Correlation Mining for Massive data | | |
| **UNIT 5** | **ASSOCIATION AND CO-OCCURRENCES** | **09 HOURS** |
| **Applications/Case Study:** Real time case studies ( Retail/ Hospital/Hotel etc)<br>**Contents:** Association rules, Apriori algorithm- simple, multi-level, multi dimensional, Eclat and FP growth. Comparative study of all Association algorithms.<br>**Self Study:** Frequent itemset concepts<br>**Further Readings:** Adaptive Apriori Algorithm | | |
| **UNIT 6** | **CLASSIFICATION MODELS USING DECISION TREE** | **05 HOURS** |
| **Applications/Case Study:** Loan defaulter detection/disease detection/recession predictions etc.<br>**Contents:** Decision trees based on Information Gain, Gain Ratio and Gini index. Comparative Analysis of all Decision tree based algorithms with different case studies.<br>**Self Study:** Different Learning Types<br>**Further Readings:** CART advancements | | |

## TEXT BOOKS


1. Jiawei Han, Micheline Kamber, Jian Pei Professor.(2011). "Data Mining: Concepts and Techniques", The Morgan Kaufmann Series in Data Management Systems, ISBN 978-9380931913.
2. Rick Sherman.(2014). "Business Intelligence Guidebook: From Data Integration to Analytics", The Morgan Kaufmann Series in Data Management Systems, ISBN 0124114616.
3. Sheldon Ross. (2017). "Introductory Statistics", Academic Press; 4th edition, Hardcover ISBN: 9780128043172 eBook ISBN: 9780128043615.
4. John D. Kelleher,Brian Mac Namee,Aoife D'Arcy.(2015), Fundamentals of Machine Learning for Predictive Data Analytics Algorithms, Worked Examples, and Case Studies.The MIT Press,ISBN-10:0262029448
5. Stephen Marsland(2015).Machine Learning: An Algorithmic Perspective, Second Edition Part of: Chapman Hall/Crc Machine Learning Pattern Recognition (21 Books). CRC Press.
6. McKinney, Wes.(2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. O'Reilly Media, Inc.


## REFERENCE BOOKS


1. Paulraj Ponniah. (2012)."Data Warehousing: Fundamentals for IT Professionals", 2nd Edition, Paperback, Wiley Publishers, ISBN 978-8126537297.
2. Ralph Kimball.(2009), "Data Warehouse Lifecycle Toolkit", Wiley, ISBN 978-0470149775
3. Maria Sueli Almeida, Missao Ishikawa, Joerg Reinschmidt, Torsten Roeber. (1999). "Getting Started with Data Warehouse and Business Intelligence", IBM Redbook, ISBN 978-0738413747.
4. Ramesh Sharda, DursunDelen, Efraim Turban. (2019). "Business Intelligence, Analytics, and Data Science: A Managerial Perspective", Pearson Publication, 4th Edition, ISBN 978-9353067021.
5. Murrey R Spiegal, Larry Stiphens.(2018). "Statistics" , 5th edition ,Schaum's Series, McGraw-Hill Education; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527


## E-RESOURCES

1. https://dl.acm.org/doi/abs/10.5555/861541
2. https://doi.org/10.1016/j.gltp.2022.04.020
3. https://doi.org/10.1007/s10462-022-10275-5
4. https://www.scribbr.com/statistics/hypothesis-testing/

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | EXPLORATORY DATA ANALYTICS LAB |
| | COURSE CODE | 2304321L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Essential of Data Science, Applied Mathematics

**COURSE OBJECTIVES :**

2304321L.CEO.1: To esign dimensional model for given data warehouse architecture.
2304321L.CEO.2: To apply the various operations on OLAP cubes.
2304321L.CEO.3: To apply data preprocessing and visualization techniques
2304321L.CEO.4: To analyze numeric prediction using regression models
2304321L.CEO.5: To use the different association rule generation algorithms
2304321L.CEO.6: To apply decision tree based classifiers on given case study

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304321L.CO.1: Apply Data wrangling , Data modeling and predictive analytics concepts on given problem statements. [L3]
2304321L.CO.2: Analyze the efficiency of the different techniques/ algorithms on the given case study and write an article on the same without plagiarism. [L4]

**COURSE ABSTRACT:**

Descriptive Analytics is the first course under Data Science track. Descriptive Analytics is a foundational course designed to equip students with the essential skills and knowledge necessary to extract actionable insights from data. This course provides a comprehensive overview of various techniques and methodologies utilized in descriptive analytics, focusing on data preprocessing, analysis, and interpretation. Students will learn how to leverage data warehouses, perform data wrangling, conduct hypothesis testing, and utilize various analytical models to gain valuable insights from data.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Design Data Warehouse** | **4 HOURS** |
| Data Modeling, Types of Dimensions and Facts, Granularity of Facts, Measures and Categorization of Measures, Making of Data Mart, Scheme Modeling (Star, Snowflake, Star Constellation Schema), Case Studies on Dimensional Modeling) | | |
| **PRACTICAL NO.02** | **Analytical Data Preprocessing** | **4 HOURS** |
| Writing OLAP queries for the case study from Assignment no.1 Making Cubes using OLAP tools. | | |
| **PRACTICAL NO.03** | **Apply Data Wrangling** | **4 HOURS** |
| Data wrangling/Curation project along with data visualization. | | |
| **PRACTICAL NO.04** | **Implemtation of Regression** | **6 HOURS** |
| Apply correct Regression model for the given application (Simple, Multiple, Polynomial, Logistic) | | |
| **PRACTICAL NO.05** | **Analysis of Associations** | **6 HOURS** |
| Analysis and optimization of Association techniques for given problem statements. | | |
| **PRACTICAL NO.06** | **Application of Classiftcation Techniques** | **6 HOURS** |
| Application based implementation of Decision tree based Classification algorithms | | |

## TEXT BOOKS


1. Jiawei Han, Micheline Kamber, Jian Pei Professor.(2011). "Data Mining: Concepts and Techniques", The Morgan Kaufmann Series in Data Management Systems, ISBN 978-9380931913.
2. Rick Sherman.(2014). "Business Intelligence Guidebook: From Data Integration to Analytics", The Morgan Kaufmann Series in Data Management Systems, ISBN 0124114616.
3. Sheldon Ross. (2017). "Introductory Statistics", Academic Press; 4th edition, Hardcover ISBN: 9780128043172 eBook ISBN: 9780128043615.
4. John D. Kelleher,Brian Mac Namee,Aoife D'Arcy.(2015), Fundamentals of Machine Learning for Predictive Data Analytics Algorithms, Worked Examples, and Case Studies.The MIT Press,ISBN-10:0262029448
5. Stephen Marsland(2015).Machine Learning: An Algorithmic Perspective, Second Edition Part of: Chapman Hall/Crc Machine Learning Pattern Recognition (21 Books). CRC Press.
6. McKinney, Wes.(2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. O'Reilly Media, Inc.


## REFERENCE BOOKS


1. Paulraj Ponniah. (2012)."Data Warehousing: Fundamentals for IT Professionals", 2nd Edition, Paperback, Wiley Publishers, ISBN 978-8126537297.
2. Ralph Kimball.(2009), "Data Warehouse Lifecycle Toolkit", Wiley, ISBN 978-0470149775
3. Maria Sueli Almeida, Missao Ishikawa, Joerg Reinschmidt, Torsten Roeber. (1999). "Getting Started with Data Warehouse and Business Intelligence", IBM Redbook, ISBN 978-0738413747.
4. Ramesh Sharda, DursunDelen, Efraim Turban. (2019). "Business Intelligence, Analytics, and Data Science: A Managerial Perspective", Pearson Publication, 4th Edition, ISBN 978-9353067021.
5. Murrey R Spiegal, Larry Stiphens.(2018). "Statistics" , 5th edition ,Schaum's Series, McGraw-Hill Education; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527


## E-RESOURCES

1. https://dl.acm.org/doi/abs/10.5555/861541
2. https://doi.org/10.1016/j.gltp.2022.04.020
3. https://doi.org/10.1007/s10462-022-10275-5
4. https://www.scribbr.com/statistics/hypothesis-testing/

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Artificial Intelligence and Machine Learning |
| | **COURSE CODE** | 2304322T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** Application Programming.

**COURSE OBJECTIVES :**

2304322T.CEO.1: Provide strong foundation of fundamental Artificial Intelligence concepts of Perception, Knowledge, Inference and Search Strategies.

2304322T.CEO.2: Present optimal methodologies and evaluating the effectiveness of statistical machine learning models.

2304322T.CEO.3: Provide the knowledge about various statistical machine learning models to build computational intelligence.

2304322T.CEO.4: Illustrate diverse applications of machine learning across various domains and real world scenarios.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304322T.CO.1: Apply basic principles of Perception, Knowledge Representation, Inference, Reasoning and Search Strategies in Artificial Intelligence [L3].

2304322T.CO.2: Utilize various machine learning statistical algorithms in a range of real-world applications [L3].

2304322T.CO.3: Evaluate the performance of machine learning models through systematic hyper-parameter optimization [L4].

2304322T.CO.4: Analyze the strengths and limitations of different AI and ML approaches [L4].

**COURSE ABSTRACT:**

This course aims to introduce the fundamental concepts of artificial intelligence to individuals from all academic backgrounds. Students will develop a broad understanding of AI technologies, their implications, and their potential applications in various fields.AI can do many things, it currently cannot perform and think exactly like human beings ,but General AI is like what you see in sci-fi films, where sentient machines emulate human intelligence, thinking strategically, abstractly and creatively, with the ability to handle a range of complex tasks.In this course introduce the machine learning field, which can be briefly defined as enabling computers make successful classification,clustering ,predictions by using regression model as well as using past experiences, has exhibited an impressive development recently with the help of the rapid increase in the storage capacity and processing power of computers. Natural language processing (NLP) is the ability to process natural, human-created text. Neural networks help computers gather insights and meaning from text data and documents. NLP has several use cases, including in these functions: Automated virtual agents and chatbots.IN this course introduced Neural Network as wel,Neural networks can help computers make intelligent decisions with limited human assistance. This is because they can learn and model the relationships between input and output data that are nonlinear and complex.

**THEORY COURSE CONTENTS**

| UNIT 1 | BASICS OF ARTIFICIAL INTELLIGENCE | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Medical Diagnosis System, Self Driving Vehicle.

**Contents:** Foundation and history of Artificial Intelligence (AI), AI applications and types, Impact and ethical concerns of AI, Intelligent Agents. Introduction to Reasoning and Knowledge Representation, First order Logic, Rule based reasoning, Architecture of expert systems, Knowledge Acquisition.

**Self Study:** Chatbot, Prompt Engineering

**Further Readings:** Artificial General Intelligence.

| UNIT 2 | AI SEARCH STRATEGIES | 08 HOURS |
|---|---|---|

**Applications/Case Study:** GPS Navigation System, Chess Game

**Contents:** Search Strategies: State Space Search, Uninformed Search (Breadth-First, Depth-First, Depth Limited, Iterative Deepening, Bidirectional), Heuristic Search (Greedy Best First Search, A* Algorithm, Admissibility of A*), Hill-climbing, Constraint Satisfaction Problem(CSP), Constraint Propagation and Inference in CSP, Local Search and Backtracking Search in CSP. Adversarial Search, Minimax Search, Alpha-Beta Pruning.

**Self Study:** Genetic Algorithm

**Further Readings:** Game Theory

| UNIT 3 | MACHINE LEARNING FUNDAMENTALS | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Real Estate Price Prediction, Healthcare Application.

**Contents:** Overview of Machine learning: Supervised, Unsupervised and Reinforcement Learning. Regression, Types of regression: Simple and Multiple Linear Regression, Polynomial Regression, Evaluation Metrics for Regression Models: Mean Squared Error, Root Mean Squared Error, Mean Absolute Error, and R-squared value.

**Self Study:** Ridge Regression, Lasso Regression, Elastic Net Regression

**Further Readings:** K-Fold Cross-Validation case study.

| UNIT 4 | INSTANCES AND PROBABILISTIC MODEL | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Customer Churn Prediction.

**Contents:** Naive Bayes: Bayes' theorem, Independence Assumption, Logistic Regression for Classification, Model Evaluation Metrics: Accuracy, Precision, Recall, F1, Confusion Matrix, ROC-AUC.

**Self Study:** k-Nearest Neighbors (KNN) for Regression and Classification.

**Further Readings:** Variation Inference.

| UNIT 5 | LINEAR AND DECISION MODELS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Pima Diabetes Prediction

**Contents:** Decision Trees, Gini Impurity, Information Gain, Pruning.

Support Vector Machines: Hyperplane, Support Vectors and Kernel Types.

Ensemble learning: Significance, Bagging, Boosting and Stacking. Performance Evaluation of Machine Learning Models.

**Self Study:** Adaboost Ensemble Learning.

**Further Readings:** Decision Tree for Regression Analysis.

| UNIT 6 | UNSUPERVISED LEARNING MODELS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Anomaly Detection and Noise Reduction

**Contents:** Association Rule, Apriori Algorithm.

Introduction to Clustering, Partitional Clustering, Hierarchical Clustering, Density Based Clustering.

Dimensionality Reduction, Feature Selection and Extraction, Principal Component Analysis.

**Self Study:** Probability Distribution Based Methods.

**Further Readings:** Linear Discriminant Analysis.

## TEXT BOOKS


1. Stuart Russel and Peter Norvig(2020). *Artificial Intelligence: A Modern Approach*. 4th Edition, Pearson . ISBN: 0-13-461099-7. Rich, Kevin Knight(2020). *Shivashankar B. Nair, Artificial Intelligence,*. 3rd Edition, TataMcGraw Hill. ISBN-13: 978-0-07-008770-5.
2. Ethem Alpaydin(2020). *Introduction to Machine Learning*. 4th Edition,The MIT Press publication. ISBN:978-0-262-04379-3.
3. S. Harrington (1987). *Computer Graphics*. 2nd Edition, McGraw-Hill publication. ISBN 0-07-100472-6.
4. Tom Mitchell(1997). *Machine Learning*. 2nd Edition, Tata McGraw-Hill publication, ISBN 007-0-42807-7.
5. Jason Bell(1994). *"Machine Learning: Hands-On for Developers and Technical Professionals*. 2nd Edition,Willey Publication,ISBN-10: 8126553375, ISBN-13: 978- 8126553372.
6. James, G., Witten, D., Hastie, T. and Tibshirani, R(2013). *An Introduction to Statistical Learning*,Springier Publication,VOl 112.


## REFERENCE BOOKS


1. Deepak Khemani (2013). *A First course in Artificial Intelligence*. 1st Edition, Mc Graw Hill,ISBN: 9781259029981.
2. Peter Harrington (2012)*Machine Learning in Action*. 2nd Edition, Dreamtech Press,ISBN 978-1-617-29018-3.
3. *Trevor Hastie,Robert Tibshirani, Jerome Friedman*. The Elements of Statistical Learning: Data Mining,Inference and Prediction 3rd Edition,ISBN: 978-0-387-84857-0.
4. Christopher M. Bishop(2016)*"Pattern Recognition and Machine Learning*. 4th Edition, Springier New York.
5. *Andrea's Muller*.Introduction to Machine Learning with Python: A Guide for Data Scientists(2016),1st Edition,Shroff/O'Reilly,ISBN-10: 9352134575, ISBN-13: 978-9352134571.


## E-RESOURCES

1. https://nptel.ac.in/courses/106105078.
2. https://nptel.ac.in/courses/106106126
3. https://nptel.ac.in/courses/106106139

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Artificial Intelligence and Machine Learning Lab |
| | COURSE CODE | 2304322L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

## COURSE OBJECTIVES :

2304322L.CEO.1: Incorporate theoretical understanding into real-world scenarios and applications of artificial intelligence.

2304322L.CEO.2: Elaborate various feature engineering and dimensionality reduction approaches for improving model performance.

2304322L.CEO.3: Design intelligent expert models for perception and prediction from intelligent environment.

2304322L.CEO.4: Enhance understanding of selecting and applying AI tools for synthesizing information and building models within application constraints.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2304322L.CO.1: Apply AI techniques, including searching and game playing, to address challenging real-life problems represented in state spaces.[L3].

2304322L.CO.2: Organize dataset to improve model performance.[L4].

2304322L.CO.3: Conduct experiments to evaluate the strengths and limitations of various AI and ML approaches. [L4].

2304322L.CO.4: Evaluate results to draw conclusions on problem-solving method effectiveness.[L5].

2304322L.CO.5: Deploy machine learning models into production environments.[L5].

**COURSE ABSTRACT:**

This course aims to introduce the practical knowledge in artificial intelligence to individuals from all academic backgrounds. Students will develop search stategy like vaccum cleaning agent, A* algorithm / technologies, their implications, and their potential applications in various fields.In this course student can able to develop the machine learning algorithms, which can be briefly defined as enabling computers make successful classification,clustering ,predictions by using regression model. Implete programs using Natural language processing (NLP) is the ability to process natural language model, human-created text. Implement Neural networks with the help of computers gather insights and meaning from text data and documents. NLP has several use cases, including in these functions: Automated virtual agents and chatbots.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Assignment 1** | **2 HOURS** |
| a) Develop Vacuum Cleaner Agent Application. b) Develop an knowledge base system consisting of facts and rules about some specialized knowledge domain of your choice. | | |
| **PRACTICAL NO.02** | **Assignment 2** | **2 HOURS** |
| Find the shortest path for any particular source and destination using A* Algorithm. OR Design and implement map coloring problem using backtracking. | | |
| **PRACTICAL NO.03** | **Assignment 3 -Regression Model** | **6 HOURS** |
| 1. Data Preparation and Model Implementation - • Select suitable dataset with continuous target variables. • Preprocess data, handle missing values, and encode categorical features.<br>2.Model Design and Implementation - • Use Linear regression,Polynomial and Multivariate regression<br>3.Model Training and Evaluation - • Split dataset into training and testing sets. • Train each model on training set. • Evaluate models using appropriate metrics(MSE,RMSE,R2)<br>4.Comparative Analysis - • Compare performance of various regression models. • Analyze strengths, weaknesses, interpretability, computational efficiency, and model complexity.<br>5.Conclusion - •Summarize findings, provide recommendations, and discuss improvement areas. | | |

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.04** | **Assignment 4 -Classiftcation Model** | **8 HOURS** |
| 1.Data Preprocessing: Prepare the dataset by handling missing values, encoding categorical variables, and scaling features.<br>2.Model Implementation: Develop classification models using SVM, Decision Trees (CART), KNN, and Naive Bayes.<br>3.Training and Evaluation: Train each model on a portion of the dataset and evaluate their performance using relevant metrics (accuracy, precision, recall, F1-score,loss).<br>4.Comparative Analysis: Compare the results obtained from each algorithm to identify patterns and differences.<br>5.Conclusion: Summarize the findings and discuss the suitability of each algorithm for various classification tasks. | | |
| **PRACTICAL NO.05** | **Lab Assignment 5: Ensemble Learning in Classiftcation: A Comprehensive Analysis of Stacking, AdaBoost, and Voting** | **6 HOURS** |
| 1.Dataset Selection and Preprocessing:Preprocess images from selected dataset for resizing, normalization, and data augmentation.<br>2.Stacking: Implement a stacking ensemble using a meta-classifier to combine predictions from base classifiers.<br>3.AdaBoost: Implement an AdaBoost ensemble using chosen base classifiers.<br>4.Voting: Implement a voting ensemble that combines the predictions of the base classifiers through majority voting.<br>5.Model Comparison: Compare the performance of the ensemble models using appropriate classification metrics.<br>6.Analysis and Interpretation: Analyze the strengths and weaknesses of each ensemble method, explore scenarios where one method may outperform the others, and discuss the impact of diversity among base classifiers on ensemble performance.<br>7.Conclusion: Summarize the findings, provide insights into when to use each ensemble method, and suggest potential areas for further research or improvement. | | |
| **PRACTICAL NO.06** | **Lab Assignment 6: Lab Assignment 6: K-means Clustering** | **4 HOURS** |
| Implement K-means clustering and Hierarchical clustering for selected dataset. Compute the following,<br>1. K-Means: Compute the squared error for k=3 and k=4 clusters<br>2. K-Means: Find optimum number of clusters<br>3. compute (and store) the squared errors of all possible clustering in hierarchical clustering<br>4. Compare k-means and hierarchical clustering with respect to error and optimum number of clusters. | | |

| PRACTICAL NO.07 | Mini Project | 6 HOURS |
|---|---|---|

Objective: 1.Design and implement a machine learning model for predictive maintenance.
Deploy the model to the cloud for real-time predictions.
2.Tasks:
Dataset Selection and Exploration:
a)Preprocess images from selected dataset for resizing, normalization, and data augmentation.
b)Classification: Label instances indicating impending equipment failure.
c)Regression: Predict the remaining useful life of equipment.
3.Model Development:
a)Implement a classification model OR
b)Implement a regression model
c)Evaluate the models using appropriate metrics.
4.Model Deployment to Cloud:
a) Choose a cloud platform for deployment.
b) Deploy the trained models using cloud services.
c)Create a REST API for real-time predictions.
5.Integration with a Web Application or Product:
a) Develop a simple interface to interact with the deployed models.
b) Allow users to input relevant features for prediction.
6.Documentation: Provide clear documentation for the entire project.
7.Testing and Validation:Perform thorough testing of the deployed models and the web application.
8.Conclusion and Future Work: Summarize project objectives, methods, and outcomes and Discuss potential areas for improvement or extension.

## TEXT BOOKS


1. Stuart Russel and Peter Norvig(2020). *Artificial Intelligence: A Modern Approach*. 4th Edition, Pearson . ISBN: 0-13-461099-7. Rich, Kevin Knight(2020). *Shivashankar B. Nair, Artificial Intelligence,*. 3rd Edition, TataMcGraw Hill. ISBN-13: 978-0-07-008770-5.
2. Ethem Alpaydin(2020). *Introduction to Machine Learning*. 4th Edition,The MIT Press publication. ISBN:978-0-262-04379-3.
3. S. Harrington (1987). *Computer Graphics*. 2nd Edition, McGraw-Hill publication. ISBN 0-07-100472-6.
4. Tom Mitchell(1997). *Machine Learning*. 2nd Edition, Tata McGraw-Hill publication, ISBN 007-0-42807-7.
5. Jason Bell(1994). *"Machine Learning: Hands-On for Developers and Technical Professionals*. 2nd Edition,Willey Publication,ISBN-10: 8126553375, ISBN-13: 978- 8126553372.
6. James, G., Witten, D., Hastie, T. and Tibshirani, R(2013). *An Introduction to Statistical Learning*,Springier Publication,VOl 112.


## REFERENCE BOOKS


1. Deepak Khemani (2013). *A First course in Artificial Intelligence*. 1st Edition, Mc Graw Hill,ISBN: 9781259029981.
2. Peter Harrington (2012)*Machine Learning in Action*. 2nd Edition, Dreamtech Press,ISBN 978-1-617-29018-3.
3. *Trevor Hastie,Robert Tibshirani, Jerome Friedman*. The Elements of Statistical Learning: Data Mining,Inference and Prediction 3rd Edition,ISBN: 978-0-387-84857-0.
4. Christopher M. Bishop(2016)*"Pattern Recognition and Machine Learning*. 4th Edition, Springier New York.
5. *Andrea's Muller*.Introduction to Machine Learning with Python: A Guide for Data Scientists(2016),1st Edition,Shroff/O'Reilly,ISBN-10: 9352134575, ISBN-13: 978-9352134571.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | CLOUD COMPUTING FOUNDATIONS |
| | COURSE CODE | 2304323T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PRE-REQUISITE KNOWLEDGE :** Data Structures, Database Management Systems, Discrete Structures and Graph Theory

**COURSE OBJECTIVES :**

2304323T.CEO.1: To introduce various cloud computing services and models
2304323T.CEO.2: Enable students to strategize the selection of optimal configurations for compute nodes
2304323T.CEO.3: To configure appropriate storage service for the specific application requirement
2304323T.CEO.4: To implement networking and security settings in cloud environment
2304323T.CEO.5: To create the application using high scalability and reliability considerations

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304323T.CO.1: Categorize different types of cloud computing services and models [L3].
2304323T.CO.2: Choose appropriate compute service configuration within a cloud environment [L3].
2304323T.CO.3: Distinguish between storage-related services utilized in application development[L3].
2304323T.CO.4: Choose the suitable database service for a given application scenario [L3].
2304323T.CO.5: Evaluate various networking and security [L5]. configurations based on specific problem-solving requirements [L3].
2304323T.CO.6: To examine different networking and security choices while developing an application [L3].

**COURSE ABSTRACT:**

Cloud Computing Foundations is one of the fundamental course to implement various Service Models and Deployment Models to be used to solve real world problems. Cloud Computing Foundations Lab assignments are designed for both Service Models and Deployment Models concepts. This course implements various operations of collecting, organizing and storing of data in an efficient way in order to solve real time problems. Learners cultivate broad and in depth knowledge of synthesizing and analyzing Service Models using appropriate compute, storage and network services in order to provide solutions to real world problems. The objective of the course is to identify global infrastructure components of AWS, understand and demsotrate AWS EC2,Load Balancing,EBS, EFS,S3,Auto Scaling.

**THEORY COURSE CONTENT**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Cloud Computing** | **8 HOURS** |

**App/System/Case study:** Amazon AWS, Microsoft Azure, Salesforce

**Contents:** Recent trends in Computing - Grid Computing, Cluster Computing, Utility Computing, Cloud Computing. Evolution of cloud computing - Business driver for adopting cloud computing Distinguishing Cloud Types, Deployment Models, Service Models, Scalability, Virtualization, Software as a service (SaaS): understanding multitenant nature, service oriented architecture, Platform as a service (PaaS): Benefits and disadvantages, Infrastructure as a service (IaaS)

Web as a portal to cloud : Overview of web protocols like HTTP, SOAP, REST and XML.

Virtualization : types, hypervisors.

Cloud economics and billing

**Self study:** Hybrid cloud service providers

**Further Reading:** REST implementation

| | | |
|---|---|---|
| **UNIT 2** | **Networking and Security Services in Cloud Computing** | **9 HOURS** |

**App/System/Case study:** Amazon VPC, Amazon Route S3, Amazon Elastic Load Balancing, Amazon Cloud Front

**Contents:** Building cloud network(VPC) : defining and provisioning isolated networks, gateways in cloud, providing private connectivity in hybrid cloud environments Scaling cloud network : automatic traffic distribution across pool of servers, direct traffic routing for achieving performance Securing network traffic : Configuring and managing firewall rules, access permission,Security Groups and NACLs Identity and Access Management in Cloud Network: Users, Groups, Roles, Permission Policies, Permission Boundary, Service Control Policies

**Self study:** Advanced Firewall Settings

**Further Reading:** VPN Connectivity in AWS

| UNIT 3 | Compute Services in Cloud Computing | 7 HOURS |
|---|---|---|

**App/System/Case study:** Amazon EC2, Virtualbox, Docker

**Contents:** Compute node architecture, parameters to consider while configuring compute node, Machine images, instances, instance types, tags, key pairs, security groups, regions and zones – types User data and metadata for instance, instance tenancy

**Self study:** Kubernetes

**Further Reading:** Virtual Machine Internal XML file

| UNIT 4 | Storage Services in Cloud Computing | 6 HOURS |
|---|---|---|

**App/System/Case study:** Amazon S3, Amazon EBS, Amazon EFS, Amazon Glacier

**Contents:** Examining the Evolution of Network Storage, Understanding Cloud-Based Data Storage, Advantages and Disadvantages of Cloud-Based Data Storage. Cloud- Based Backup Systems

Types of cloud storage – File Storage - EFS, Block Storage – Elastic Block Storage, Object Based Storage – S3

**Self Study:** Google File System

**Further Reading:** CEPH File System

| UNIT 5 | Database Services in Cloud Computing | 8 HOURS |
|---|---|---|

**App/System/Case study:** Amazon RDS, Amazon DynamoDB, Amazon ElastiCache, Amazon Neptune

**Contents:** Need for cloud databases, considerations for cloud databases, architecture and common characteristics, Data Models

Relational database, Key – value based database, In-memory database, Document based database, Graph based database, Time series database, Ledger based database.

High availability and load balancing in databases

**Self Study:** Real time graph databases

**Further Reading:** Blockchain

| UNIT 6 | High Availability and Scalability Services in Cloud Computing | 7 HOURS |
|---|---|---|

**App/System/Case study:** Amazon EC2, Amazon EBS, AWS Autoscaling

**Contents:** Definition, elements of high availability. High availability for compute resources, high availability for databases and high availability for storage services.

Elastic Load Balancing – Types of load balancers, Target Groups, Health monitoring autoscaling Groups: Scaling policies, Launch templates, Min, Max and Desired counts .

Scalability issues, vertical scaling vs. horizontal scaling vs. diagonal scaling, difference between scalability and elasticity

**Self Study:** Autoscalling algorithms

**Further Reading:** Highly available and salable file system features

## TEXT BOOK


1. Wittig, Michael, Andreas Wittig and Ben Whaley (2023). *Amazon web services in action*. 3rd Edition,Manning, ISBN 9781633439160.
2. Murty, James, Andreas Wittig and Ben Whaley (2008). *Programming amazon web services: S3, EC2, SQS, FPS, and SimpleDB*. O'Reilly Media, Inc., ISBN 9780596515812.
3. David Clinton and Ben Piper (2021). *AWS Certified Solutions Architect Study Guide - Associate SAA-C02 Exam*. 3rd Edition,Sybex, ISBN 1119713080.
4. Albert Anthony (2017). *Mastering AWS Security,: Create and maintain a secure cloud ecosystem*, Packt Publishing Limited, ISBN 9781788293723.
5. van Vliet, Jurg, Flavia Paganelli, and Jasper Geurtsen (2013). *Resilience and Reliability on AWS*. 1st Edition,O'Reilly Media, ISBN 9789351100010.
6. Sarkar, Aurobindo, and Amit Shah (2018). *Learning AWS: Design, build, and deploy responsive applications using AWS Cloud components*. 2nd Edition,Packt Publishing Limited, ISBN 9781787281066.


## REFERENCE BOOK


1. Michael J. Kavis (2014). *Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)*. 1st Edition,Wiley CIO, ISBN 9781118617618
2. Wittig, John R. Vacca (2016). *Cloud Computing Security: Foundations and Challenges*. 1st Edition,CRC Press, ISBN 9781482260946.
3. Furht, Borivoje, and Armando Escalante (2010). *Handbook of Cloud Computing*. 3rd Edition,Springer, ISBN 9781441965233.


## E-R ESOURCES

1. https://docs.aws.amazon.com/
2. https://www.workshops.aws/
3. https://www.terraform.io/
4. https://boto3.amazonaws.com/v1/documentation/api/latest/index.html

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | CLOUD COMPUTING FOUNDATIONS LAB |
| | COURSE CODE | 2304323L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE KNOWLEDGE :** Data Structures, Database Management Systems, Discrete Structures and Graph Theory

**COURSE OBJECTIVES :**

2304323L.CEO.1: To introduce various cloud computing services and models
2304323L.CEO.2: Enable students to strategize the selection of optimal configurations for compute nodes
2304323L.CEO.3: To configure appropriate storage service for the specific application requirement
2304323L.CEO.4: To implement networking and security settings in cloud environment
2304323L.CEO.5: To create the application using high scalability and reliability considerations

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304323L.CO.1: Categorize different types of cloud computing services and models [L3].
2304323L.CO.2: Choose appropriate compute service configuration within a cloud environment [L3].
2304323L.CO.3: Distinguish between storage-related services utilized in application development [L3].
2304323L.CO.4: Choose the suitable database service for a given application scenario [L3].
2304323L.CO.5: Evaluate various networking and security [L3]. configurations based on specific problem-solving requirements [L5].
2304323L.CO.6: To examine different networking and security choices while developing an application [L4].

**COURSE ABSTRACT:**

Cloud Computing Foundations is one of the fundamental course to implement various Service Models and Deployment Models to be used to solve real world problems. Cloud Computing Foundations Lab assignments are designed for both Service Models and Deployment Models concepts. This course implements various operations of collecting, organizing and storing of data in an efficient way in order to solve real time problems. Learners cultivate broad and in depth knowledge of synthesizing and analyzing Service Models using appropriate compute, storage and network services in order to provide solutions to real world problems. The objective of the course is to identify global infrastructure components of AWS, understand and demsotrate AWS EC2,Load Balancing,EBS, EFS,S3,Auto Scaling.

**PRACTICAL:**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **First Virtual Machine on AWS** | **4 HOURS** |
| Launching the virtual machine on Amazon AWS and doing basic settings | | |
| **PRACTICAL NO.02** | **Storage Conftguration** | **4 HOURS** |
| Configuring various storages available on AWS and storing, retrieving, deleting the data from those storage applications | | |
| **PRACTICAL NO.03** | **Database Conftguration** | **4 HOURS** |
| Configuring and using various databases available on Amzon AWS | | |
| **PRACTICAL NO.04** | **Networking and Security Services Conftguration** | **6 HOURS** |
| Configuring various networking and security options | | |
| **PRACTICAL NO.05** | **High availability and scalability services** | **4 HOURS** |
| Configuration of high availability and scalability services | | |
| **PRACTICAL NO.06** | **Project** | **6 HOURS** |
| Implement a project based on all the services studied for a given application on Amazon AWS | | |

**TEXT BOOK**


1. Wittig, Michael, Andreas Wittig and Ben Whaley (2023). *Amazon web services in action*. 3rd Edition,Manning, ISBN 9781633439160.
2. Murty, James, Andreas Wittig and Ben Whaley (2008). *Programming amazon web services: S3, EC2, SQS, FPS, and SimpleDB*. O'Reilly Media, Inc., ISBN 9780596515812.
3. David Clinton and Ben Piper (2021). *AWS Certified Solutions Architect Study Guide - Associate SAA-C02 Exam*. 3rd Edition,Sybex, ISBN 1119713080.
4. Albert Anthony (2017). *Mastering AWS Security,: Create and maintain a secure cloud ecosystem*, Packt Publishing Limited, ISBN 9781788293723.
5. van Vliet, Jurg, Flavia Paganelli, and Jasper Geurtsen (2013). *Resilience and Reliability on AWS*. 1st Edition,O'Reilly Media, ISBN 9789351100010.
6. Sarkar, Aurobindo, and Amit Shah (2018). *Learning AWS: Design, build, and deploy responsive applications using AWS Cloud components*. 2nd Edition,Packt Publishing Limited, ISBN 9781787281066.

## REFERENCE BOOK


1. Michael J. Kavis (2014). *Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)*. 1st Edition,Wiley CIO, ISBN 9781118617618
2. Wittig, John R. Vacca (2016). *Cloud Computing Security: Foundations and Challenges*. 1st Edition,CRC Press, ISBN 9781482260946.
3. Furht, Borivoje, and Armando Escalante (2010). *Handbook of Cloud Computing*. 3rd Edition,Springer, ISBN 9781441965233.


## E-RESOURCES

1. https://docs.aws.amazon.com/
2. https://www.workshops.aws/
3. https://www.terraform.io/
4. https://boto3.amazonaws.com/v1/documentation/api/latest/index.html

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | CRYPTOGRAPHY AND INFORMATION SECURITY |
| | COURSE CODE | 2304324T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** Requires knowledge of Computer Networks, calculus, and basic linear algebra

**COURSE OBJECTIVES :**

2304324T.CEO.1: To prepare Cryptography theories, algorithms, and systems.
2304324T.CEO.2: To Explain necessary Approaches and Techniques to build protection mechanisms to secure information.
2304324T.CEO.3: To understand the basic categories of threats to computers and their information.
2304324T.CEO.4: To approach the fundamental ideas of public-key cryptography and symmetric key cryptography.
2304324T.CEO.5: Critically discuss IP Security, Web security, and Firewalls.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304324T.CO.1: Examine the security threats and the security mechanisms to counter them. [L3]
2304324T.CO.2: Apply security principles to protect the data.[L3].
2304324T.CO.3: Demonstrate common symmetric and asymmetric encryption algorithms used as standards in modern cryptosystems [L3].
2304324T.CO.4: Compare the properties of hash algorithms in digital signature. [L4]
2304324T.CO.5: Analyze information security policies.[L5]
2304324T.CO.6: Inspection network security threats and provide solutions to protect the network.[L5]

**COURSE ABSTRACT:**

This course will deal with the construction and analysis of different security techniques that prevent third parties from reading private data between two parties. Cryptography has evolved to address the encryption and decryption of user data through the internet and computer systems. It is a branch of cyber and network security.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION OF SECURITY IN COMPUTING ENVIRONMENT** | **07 HOURS** |

**Applications/Case Study:**Threats, Vulnerabilities, and Controls.

**Contents:** Introduction to the concepts of Security, Need for Security; Security Attacks, Types of Attacks, Classical and Modern Cryptography; Security Services and Mechanisms. Substitution Techniques, Transposition Techniques, Chinese Remainder theorem, and Cryptography techniques.

**Self Study:** : Prime numbers

**Further Readings:** stenography Foundations of modern cryptography.

| | | |
|---|---|---|
| **UNIT 2** | **SYMMETRIC KEY CRYPTOGRAPHY** | **08 HOURS** |

**Applications/Case Study:** Properties of Trustworthy Encryption Systems.

**Contents:** Modular Arithmetic, Euclidean and Extended Euclidean algorithm,Data Encryption Standard (DES) Algorithm – Overview of the DES Algorithm; Triple DES; Security of the DES; Advanced Encryption Standard (AES), International Data Encryption Standard (IDEA), Cloud Encryption, Blowfish, RC4.

**Self Study:** Cloud Security Risk and Counter Measures

**Further Readings:**RC5

| | | |
|---|---|---|
| **UNIT 3** | **PUBLIC KEY ENCRYPTION** | **08 HOURS** |

**Applications/Case Study:** Case study on Public key cryptography.

**Contents:** An introduction to asymmetric key encryption, Characteristics of Public Key System; RSA Technique, Encryption Fill Algorithm, Boundary Fill Method; Key Exchange; Diffie Hellman Key exchange, Elliptic Curve Cryptography, Quantum Cryptography.

**Self Study:** Post-Quantum Cryptography.

**Further Readings:**Elgamal cryptography.

| | | |
|---|---|---|
| **UNIT 4** | **HASH FUNCTIONS AND DIGITAL SIGNATURE** | **07 HOURS** |

**Applications/Case Study:** Demonstration Digital Certificate Creation.

**Contents:** Hash functions: Authentication requirement, MAC, HMAC, Hash algorithms: Message digest algorithms, SHA algorithms, Digital signature, DSS(Digital Signature Standard). Public key cryptographic standards (PKCS).

**Self Study:** The PKIX model.

**Further Readings:**Implementation of Digital Certificate

| UNIT 5 | EMAIL AND WEB SECURITY | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Case study on security policy

**Contents:** Email Security: SMTP, Mail message formats, Mail access protocols, Pretty good privacy(PGP), Operational description of PGP, S/MIME, S/MIME functionality. Web Security: Secure Socket Layer(SSL architecture, Transport Layer Security 1.2(TLS), Secure Electronic Transaction(SET), SET components, SET transaction, JWT (JSON Web Token) Authentication.

**Self Study:** Overview of HTTPS.

**Further Readings:** Cryptographic keys and key rings.

| UNIT 6 | IP SECURITY PRACTICE AND SYSTEM SECURITY | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Demonstration of IP Security and firewall.

**Contents:** IP Security Overview: IPSec architecture, IPSec services, IPSec Applications and benefits, VPN, What is system security, Types of layers and attacks on each layer, Different types of Firewalls, Intrusion Detection.

**Self Study:** DDOS attack

**Further Readings:** Firewall configuration.

## TEXT BOOKS


1. Atul Kahate, *"Cryptography and Network Security",*. 7th The McGraw Hill Publication Third Edition, ISBN – 13: 978-0-07-064823-4.
2. Eric Maiwald, *"Network Security: A Beginners' Guide" ,*.7th ISBN: 978-007-179571-5.


## REFERENCE BOOKS


1. William Stallings, *"Cryptography and Network Security",* . 13th Seventh Edition ISBN-10:1-292-15858-1
2. Behrouz A. Forouzan, *"Introduction to Cryptography and Network Security",* . 13th McGraw-Hill Forouzan Networking Series, ISBN 978–0–07–287022–0.


## E-RESOURCES

1. https://www.cs.vsb.cz/ochodkova/courses/kpb/cryptography-and-network-security *principles – and-practice-7th-global-edition.pdf*

2.*https : //nptel.ac.in/courses/*106105031

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | CRYPTOGRAPHY AND INFORMATION SECURITY LAB |
| | **COURSE CODE** | 2304324L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Number Theory, Computer Networks.

**COURSE OBJECTIVES :**

2304324L.CEO.1: To identify basic security attacks and services and the importance of number theory
2304324L.CEO.2: To understand symmetric and asymmetric key algorithms for cryptography
2304324L.CEO.3: To design a security solution for a given application
2304324L.CEO.4: To analyze key management techniques
2304324L.CEO.5: To understand authentication functions and how message authentication codes and hash functions work FOR Firewalls.

**COURSE OUTCOMES :**

After successful completion of the course, students Shall be able to,

2304324L.CO.1: Implement cryptography, the CIA triad of information security types.[L3].
2304324L.CO.2: Apply the various encryption mechanisms for secure transmission of data and key management required for encryption.[L3].
2304324L.CO.3: Build digital signature schemes and message authentication techniques.[L3]

**COURSE ABSTRACT:**

This course will deal with the construction and analysis of different security techniques that would prevent any third parties from reading private data between two parties. cryptography has evolved to address the encryption and decryption of user data through the internet and computer systems, It is a branch of cyber and network security

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Write a program to encrypt and decrypt the message using encryption decryption techniques 1. Substitute Method 2. Transposition Method** | **4 HOURS** |
| | | |
| **PRACTICAL NO.02** | **Develop a program in C++/Java/Python on Advanced Extended Euclidean Algorithm.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.03** | **Write a program to implement one of Symmetric Key Cryptography (AES, /DES/ RC4 etc.).** | **4 HOURS** |
| | | |
| **PRACTICAL NO.04** | **Write a program to implement public key cryptography algorithm RSA.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.05** | **Implement Diffie Hellman key exchange algorithm in client server architecture.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.06** | **Calculate the message digest of a text using the SHA-1 or MD5 algorithm in JAVA/Python/C++.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.07** | **Create your own digital certiftcate using java key tool** | **2 HOURS** |
| | | |
| **PRACTICAL NO.08** | **Develop a program in .NET,/Python to encode and decode the message for Authentication using HMAC SHA256** | **4 HOURS** |
| | | |

## TEXT BOOKS


1. Eric Maiwald (2021). *Network Security: A Beginners' Guide*. 13th Edition, ISBN: 978-0-07-179571-5.
2. Atul Kahate (2008),. *Cryptography and Network Security, Tata Mc Grawhill, India.*. 2th Edition, ISBN: 978-0-07-064823-4.


## REFERENCE BOOKS


1. William Stallings . *Cryptography and Network Security Prentice Hall, Seventh* . 7th Edition, ISBN-10:1-292-15858-1 .
2. Matt Bishop, . *Computer Security Prentice Hall, Seventh* . 1th Edition, Addison-Wesley, 2004


## E-R ESOURCES

1. IIT Delhi, Virtual lab on Cryptography- https://cse29-iiith.vlabs.ac.in/

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | LINUX ADMINISTRATION-I |
| | COURSE CODE | 2304361L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Fundamental of Linux operating system, Operating system

**COURSE OBJECTIVES :**

2304361L.CEO.1: To configuring, installing, and upgrading Linux systems using established standards and procedures.
2304361L.CEO.2: To understand Redhat Linux operational support.
2304361L.CEO.3: To monitor system performance and availability.
2304361L.CEO.4: Gain sufficient skill to perform core system administration tasks on Red Hat Enterprise Linux

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304361L.CO.1: Utilize essential Linux administration tasks [L3].
2304361L.CO.2: Experiment with installation,networking and user profiles. [L3].
2304361L.CO.3: Examine physical storage, file systems and log files [L3].
2304361L.CO.4: Inspect the Linux processes,control services,daemons and basic security administration.[L4].
2304361L.CO.5: Analyze Redhat Linux System with a comprehensive and systematic approach [L4].

**COURSE ABSTRACT:**

Red Hat System Administration I. The course provides students with Linux administration ”survival skills” by focusing on core administration tasks. Red Hat System Administration I also provides a foundation for students who plan to become full-time Linux system administrators by introducing key command-line concepts and enterprise-level tools. and also to build foundational skills that an RHCSA-certified Red Hat Enterprise Linux system administrator needs.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Introduction to Linux.** | **4 HOURS** |
| **PRACTICAL NO.02** | **Accessing the Command Line: Accessing the Command Line,Accessing the Command Line Using the Desktop,Executing Commands Using the Bash Shell** | **4 HOURS** |
| **PRACTICAL NO.03** | **Managing Files From the Command Line** | **4 HOURS** |
| **PRACTICAL NO.04** | **Getting Help in Red Hat Enterprise Linux.** | **4 HOURS** |
| **PRACTICAL NO.05** | **Create, view, and edit text ftles from command output or in an vim editor Files** | **4 HOURS** |
| **PRACTICAL NO.06** | **Manage local Linux users and groups: Manage local Linux users and groups, and administer local password policies.** | **4 HOURS** |
| **PRACTICAL NO.07** | **Control access to ftles with Linux ftle system permissions: Set Linux ftle system permissions on ftles and interpret the security effects of different permission settings.** | **4 HOURS** |
| **PRACTICAL NO.08** | **Monitor and manage Linux processes: Obtain information about the system, and control processes running on it** | **4 HOURS** |
| **PRACTICAL NO.09** | **Control services and daemons: Control and monitor network services and system daemons using Systemd** | **4 HOURS** |
| **PRACTICAL NO.10** | **Conftgure and secure OpenSSH service: Access and provide access to the command line on remote systems securely using OpenSSH** | **4 HOURS** |
| **PRACTICAL NO.11** | **Analyse and store logs: Locate and accurately interpret relevant system log ftles for troubleshooting purposes.** | **4 HOURS** |
| **PRACTICAL NO.12** | **Manage Red Hat Enterprise Linux networking: Conftgure basic IPv4 networking on Red Hat Enterprise Linux systems** | **4 HOURS** |

| | | |
|---|---|---|
| **PRACTICAL NO.13** | **Archive and copy ftles between systems: Archive ftles and copy them from one system to another. Install and update software packages: Download, install, update, and manage software packages from Red Hat and yum package repositories** | **4 HOURS** |
| **PRACTICAL NO.14** | **Access Linux ftle systems: Access and inspect existing ftle systems on a Red Hat Enterprise Linux system** | **4 HOURS** |
| **PRACTICAL NO.15** | **Analyze Servers and Get Support:Analyze and Manage Remote Servers,Create a Diagnostics Report, Detect and Resolve Issues with Red Hat Insights** | **4 HOURS** |

**TEXT BOOKS**

1. Red Hat Enterprise Linux 9.0, ”RH124: RED HAT SYSTEM ADMINISTRATION I”, Student Guide

**REFERENCE BOOKS**

1. Red Hat Enterprise Linux 8.0, ”RH124: RED HAT SYSTEM ADMINISTRATION I”, Student Guide

**E-RESOURCES**

1. https://rha.ole.redhat.com/rha/app/courses/rh124

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | WEB TECHNOLOGY |
| | **COURSE CODE** | 2304362L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Database Management System

## COURSE OBJECTIVES :

2304362L.CEO.1: To Illustrate the concepts and principles of web applications design and development.
2304362L.CEO.2: To introduce scripting language concepts for developing client-side applications.
2304362L.CEO.3: To practice server-side programming features
2304362L.CEO.4: To build responsive web applications.
2304362L.CEO.5: To know the usefulness of web services.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2304362L.CO.1: Construct websites using fundamental web languages, technologies and tools [L3].
2304362L.CO.2: To Develop a front-end web application using ReactJS [L3].
2304362L.CO.3: To Construct and configure a backend server using NodeJS and ExpressJS framework [L3].
2304362L.CO.4: To Design a RESTful API for the front-end to access backend services. [L3].

**COURSE ABSTRACT:**

Web Development course syllabus aims to teach about front-end, back-end, and full-stack Web Development. Web Development course covers various topics under Web Development such as Database Management, Web Publishing, Web Design, and Web Programming. Some of the important topics covered in this course include Web Overview and Introduction to Web Development Tools, HyperText Markup Language and Cascading Style Sheets, Introduction to JavaScript, JS Functions and Objects, JavaScript and the DOM, ExpressJs, ReactJs, NodeJs, Moongodb etc. Full stack development using MERN technology.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **HTML, CSS and Frameworks (Bootstrap)** | **10 HOURS** |

Pre Work: Installation and Configuration of Web Application Servers- Tomcat.

1. Design and develop any suitable single page web application using HTML/DHTML, CSS/CSS3 and Framework.

• Responsive website design with respect to layouts

NOTE : Each student has to create a webpage Example : Amazon.co.in front page etc.

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Javacript** | **10 HOURS** |

2. Design and develop any suitable web application to demonstrate the capabilities of Javacript.

• Use JSON and Array for storing the data, before saving the data, validate it and show proper error messages.

Note : Students have to build web pages for Interactive type applications. Example Calculator, Chat windows etc.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Front-End JavaScript Frameworks: ReactJS** | **8 HOURS** |

3. Design, develop and deploy an web application to demonstrate the client side validation using REACTJS. Note : Students have to do Client-side validation / Interactive type applications.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Server-side Development: NodeJS** | **8 HOURS** |

4. Design, develop and deploy an web application to demonstrate the server side validation using NodeJS.

Note : Student will Demonstrate all the capabilities of NodeJS.

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **Web Application Framework: ExpressJS** | **6 HOURS** |

5. Design, develop and deploy an web application to demonstrate the server side validation using ExpressJS.

Note : Student will demonstrate all the capabilities of ExpressJS.

| PRACTICAL NO.06 | RESTful API | 8 HOURS |
|---|---|---|
| 6. Create an API to perform CRUD operation in the database and deploy the application on any web hosting provider and test the API using Postman.<br>Note : Student will demonstrate the building and deploying of API's. | | |
| **PRACTICAL NO. 7** | **NoSQL Database (MongoDB)** | **10 HOURS** |
| 7. Design, develop and deploy an web application to interact with NoSQL database from a Node application.<br>Note : Student will demonstrate the working the NoSQL<br>Self-study Component : Fundamentals of DynamoDB, Fundamentals of Apache Cassandra | | |

## TEXT BOOKS


1. Ralph Moseley, M.T. Savaliya. *Developing Web Applications.* Willy India,2th Edition, ISBN 9788126538676.
2. Chris Minnick,. *Beginning React JS Foundations Building User Interfaces with ReactJS: An Approachable Guide.* Willy India,1st Edition 2023, ISBN 9781119685630.


## REFERENCE BOOKS


1. Aleksa Vukotic and James Goodwill. (2021).*Apache Tomcat 7.* Apress.
2. B. M. Harwani, (2010). *Developing Web Applications in PHP and AJAX.* Tata McGraw-Hill.


## E-R ESOURCES

1. https://www.w3schools.com/
2. https://www.coursera.org/
3. https://getbootstrap.com/
4. https://infyspringboard.onwingspan.com/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Mobile Application Developement |
| | **COURSE CODE** | 2304363L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Requires knowledge of Course Names without course code

**COURSE OBJECTIVES :**

2304363L.CEO.1: To apply Java programming concepts to Android app development.
2304363L.CEO.2: To design and develop application for the Android platform
2304363L.CEO.3: To understand mobile application development using Android Studio

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304363L.CO.1: Install and configure Android application development tools [L3].
2304363L.CO.2: Design and develop User Interfaces for the Android platform [L3].
2304363L.CO.3: Apply SQLite database techniques to store information in persistence storage [L3].
2304363L.CO.4: Construct various Layouts and Widgets in Android Applications [L3].
2304363L.CO.5: Develop and publish mobile app.[L3]

**COURSE ABSTRACT:**

This course is designed to provide with practical hands-on experience in creating, designing, and implementing android applications. Throughout this lab, students will be able to Learn Android Fundamentals, Mastering User Interface Design, Implement Functionality, Utilize APIs and Libraries, Testing and Debugging, Publishing and Distribution. The exciting world of mobile app development that specifically focuses on the Android platform. This lab is structured to equip with the fundamental skills and knowledge required to develop Android applications effectively. This course will provide a solid foundation in the development of Android applications, as Android being one of the most popular mobile operating systems worldwide, offers vast opportunities for developers to create innovative and impactful applications that can reach millions of users globally.

GUIDELINES FOR CONDUCTION OF LAB

1. Course Teacher or Lab Instructor may frame the assignments/mini-project by understanding the prerequisites, technological aspects, utility and recent trends related to the respective courses.
2. According to assigned number of hours, course instructor has to decide minimum number of practical assignments.
**3:** Preferably there should be multiple sets of assignments/mini-project and distribute among batches of students.
**4:** Mini-project can be completed in group of 2 to 3 students

CONTENTS

- Basic building blocks of Android with example
- Android Layouts and UI composition
- Database SQLite, Shared Preferences and Files
- Notifications
- Location Service and Maps
- Creating distributable APK and Publishing

| PRACTICAL | | |
|---|---|---|
| **PRACTICAL NO.01** | **Installation of Android Studio and Introduction of Android** | **4 HOURS** |
| a. Installing all required software's for android development and emulator | | |
| **PRACTICAL NO.02** | **Basic building blocks of Android with example** | **6 HOURS** |
| a. Understanding all basic building blocks of Android [activities, views, intents, etc.<br>b. Assignment based on Activity and Intents<br>c. Assignment based on android service | | |
| **PRACTICAL NO.03** | **Android Layouts and UI composition** | **8 HOURS** |
| a. Assignment based on Linear and Constraint Layout.<br>b. Assignment based on List View<br>c. Assignment based on Relative, Frame and Grid Layout | | |
| **PRACTICAL NO.04** | **Database SQLite, Shared Preferences and Files** | **8 HOURS** |
| a. Assignment based on saving some string data in Shared Preference<br>b. Assignment based on saving files in mobiles<br>c. Assignment based on connecting with SQLite performs CRUD.<br>d. Assignment based on accessing public folders of android. | | |
| **PRACTICAL NO.05** | **Notiftcations** | **6 HOURS** |
| a. Assignment based on Broadcast Receivers<br>b. Assignment based on Services and notifications<br>c. Assignment based on Toast | | |
| **PRACTICAL NO.06** | **Firebase** | **8 HOURS** |
| a. Assignment based on adding firebase to project<br>b. Assignment based on firebase cloud messaging<br>c. Assignment based on data push | | |
| **PRACTICAL NO.07** | **Location Service and Maps** | **8 HOURS** |
| a. Assignment based on fetching device location using GPS<br>b. Assignment based on loading google map in application<br>c. Assignment based on showing device location on map<br>d. Assignment based on geocoding. | | |
| **PRACTICAL NO.08** | **Creating distributable APK and Publishing** | **12 HOURS** |
| a. Assignment on creating APK with all required security concern<br>b. Assignment based on publishing app on Play Store. | | |

## TEXT BOOKS


1. Barry Burd. (2015). *Android Application Development All-in-One For Dummies*. Wiley Brand, ISBN: 978-8126557943
2. Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti (2011). *Android SDK 3 for Dummies*. Wiley, ISBN: 9781118008256
3. Zigurd Mednicks, Laird Dornin, G. Blake Meike, Masumi Nakamura (2012). *Programming Android*. O'Reilly Media Inc,ISBN: 9781449316648.


## REFERENCE BOOKS


1. Dawn Griffiths, David Griffiths (2021). *Head First Android Development: A Learner's Guide to Building Android Apps with Kotlin*, O'Reilly Media.
2. Michael Burton (2015). *Android App Development For Dummies*, Wiley. ISBN: 978-8126557868
3. Meier Reto (2012). *Professional Android 2 Application Development*, Wiley India, ISBN: 9788126525898.
4. Marko Gargenta, Masumi Nakamur (2014). *Professional Learning Android: Develop Mobile Apps Using Java and Eclipse*, O'Reilly Media, Inc. ISBN: 9781449336257.
5. Lombardo John, Rogers Rick: Mednieks Zigurd (2010). *Android Application Development*, Shroff Publishers, ISBN: 9788184047332


## E-RESOURCES

1. Official android doc : https://developer.android.com/docs

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | UI/UX DESIGN |
| | **COURSE CODE** | 2304364L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE KNOWLEDGE :**

**COURSE OBJECTIVES :**

2304364L.CEO.1: To apply the foundations of Human Computer Interaction.
2304364L.CEO.2: To Understand the design technologies for individuals and persons with disabilities.
2304364L.CEO.3: To apply the guidelines, principles and standards for user interface design.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304364L.CO.1: Identify human factors and usability issues related with computing applications. [L2].
2304364L.CO.2: Apply suitable design principles, models and usability guidelines for user interface design [L3].
2304364L.CO.3: Demonstrate the impact of usability evaluation and testing in computing applications [L2].
2304364L.CO.4: Design user interfaces using required processes and standards.[L6].

**COURSE ABSTRACT:**

UI/UX, which stands for User Interface/User Experience, is a course that focuses on creating intuitive, visually appealing, and user-friendly digital products and experiences. It combines principles from various disciplines such as design, human psychology,ergonomics and technology to enhance usersatisfaction and engagement.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Understanding Human Factors – Input Output Channels , Memory, Thinking, Emotions, Ergonomics. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Identifying Faulty Designs, Miller's Principle, Models of interactions- Norman's Action Model, Gulf of Execution and Evaluation, Errors – Mistakes, Slips, Lapses and Violations, | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Understanding Design Process, Iterative Design, Navigation Design, Colors, Metaphors, Interaction Styles | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| UI design and elements current UI design patterns style guides and design systems material design and other design systems. | | |
| **PRACTICAL NO.05** | | **4 HOURS** |
| Identify specialized users and related facilities for a selected product or system and make necessary suggestions for its improved accessibility design. | | |
| **PRACTICAL NO.06** | | **4 HOURS** |
| Empathizing through Enquiry model to collect and listing of User and UX Requirements. | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Design user persona for the users of selected product or system. | | |
| **PRACTICAL NO.08** | | **4 HOURS** |
| Conduct a contextual inquiry for selected product or system. | | |
| **PRACTICAL NO.09** | | **4 HOURS** |
| Design an interface prototype for selected product or system. | | |
| **PRACTICAL NO.10** | | **4 HOURS** |
| Design an interface prototype for selected product or system (GOMS, GOEE). | | |

| | | |
|---|---|---|
| **PRACTICAL NO.11** | | **4 HOURS** |
| Design an interface prototype for selected product or system after Peer Expert Review 1. | | |
| **PRACTICAL NO.12** | | **4 HOURS** |
| Evaluate an interface using usability evaluation technique. | | |
| **PRACTICAL NO.13** | | **4 HOURS** |
| Evaluate an interface using usability evaluation technique. | | |
| **PRACTICAL NO.14** | | **4 HOURS** |
| Expert Evaluation – Cognitive walk through and User Based Evaluation | | |
| **PRACTICAL NO.15** | | **4 HOURS** |
| Demonstration and Justification of UI/UX Design (Conclusion) | | |

**TEXT BOOKS**

1. Alan Dix, Janet Finlay. (2004). *Human Computer Interaction*. 3rd Edition, Pearson publication ISBN 978-8131717035.

**REFERENCE BOOKS**

1. Ben Shneiderman. *Designing the User Interface*. 3rd Edition, Pearson publication . ISBN 978-8131721636.

**E-R ESOURCES**

1. https://nptel.ac.in/courses/106106177

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Major Project - I |
| | **COURSE CODE** | 2304391L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304391.CEO.1: To equip students with the ability to conduct thorough literature reviews, identifying relevant academic and industry sources.

2304391.CEO.2: To introduce fundamental design principles and methodologies applicable to engineering and technology projects.

2304391.CEO.3: To teach students the basics of creating models/designs to represent systems with modelling tools and software commonly used in industry and research.

2304391.CEO.4: To understand how simulation tool can be used for iterative design improvement and optimization.

2304391.CEO.5: To guide students how to communicate their project findings clearly and concisely through written reports.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304391.CO.1: Apply mathematical, scientific, and engineering principles in the design and development of their projects [L3].

2304391.CO.2: Analyze, and solve complex engineering problems, demonstrating proficiency in research methodologies and modern tools [L4].

2304391.CO.3: Assess the societal and environmental impacts of their engineering solutions and incorporate ethical considerations into their projects [L5].

2304391.CO.4: Communicate their project ideas and results effectively through presentations and reports, and work collaboratively in teams [L3].

2304391.CO.5: Apply effective project management skills, including planning, resource allocation, and adherence to timelines, while engaging in continuous learning and improvement [L3].

## COURSE ABSTRACT:

The project is most important part of undergraduate curriculum and enables student's to develop analytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Project Design, Project Implementation and Project Evaluation. The first phase of Project Design mainly focuses on formulating system's requirement, background/literature review, and defining scope, objective and apply project management/modeling tools to design proposed solution. This enables students to apply their technical acumen and innovativeness in proposing methodology, milestones, and expected outcome.

## GUIDELINES

1. Every project group should consist of minimum 03 and maximum of 04 students.
2. The group members may be from different programs to support the interdisciplinary functioning.
3. Project group members and title of the project need to be approved by Project Guide and School.
4. Projects should preferably have a national/international industry/academic/research collaboration.
5. User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
6. The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.
7. Define proposed solution and apply project management/modeling tools for project planning and design.
8. Critically analyze various solutions/techniques to solve real world problems and perform feasibility study to select and justify proposed solution.
9. Define outcome, milestones, definite roadmap for project design, implementation, evaluation and documentation.

**Collaborative/Sponsored Project**

1. Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for project work.
2. Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization, anytime before the commencement of the sixth semester.
3. Proposed Collaborative Project work need to reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of minimum 12 months to 18 months.
4. Final assessment will be carried out in presence of faculty mentor, external mentor and examiner.

**TIMELINE**

1. Exploration of fore front research/specialization areas and opportunities in the various fields.
2. Formation of Project Group. Finalization of area of work/title as per forefront areas.
3. Exploration of abridged courses, valid resources, challenges, relevance with current opportunities.
4. Background study Systematic literature review.
5. Literature review documentation for Project Report and Research Article.
6. Project Review I Presentation.
7. Define problem statement and objectives.
8. Define scope of the work and Outline of the work.
9. Project Design, Modelling, Simulation etc.
10. Proposed Methodology of the solution and its documentation.
11. Project Review II Presentation.
12. Project Documentation: Ethics in Writing
13. Project Documentation: Final Synopsis
14. Project Documentation: Project Report Writing

## ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Background Study and Literature Review (10 Marks)
2. Synopsis (5 Marks)
3. Project Review I: Problem Identification, Motivation, Relevance, Background Study, Literature Review (10 Marks)
4. Project Review II: Literature Review, Problem Definition, Project Planning, Analysis and Design (10 Marks)
5. Project Report (10 Marks)
6. Final Presentation and Demonstration (30 Marks)

## TEXT BOOKS


1. John M. Nicholas. (2012). *Project Management for Engineering, Business and Technology*. 4th Edition, Butterworth-Heinemann. ISBN 978-0080967042.
2. Leslie Lamport. (1994). LaTeX: *A document preparation system, User's guide and reference manual*. 2nd Edition, Addison-Wesley. ISBN 978-0201529838.


## REFERENCE BOOKS


1. Michelle Reid. (2018). *Report Writing (Pocket Study Skills)*. 2nd Edition, Bloomsbury Publishing. ISBN 978-0230376557.
2. Sara Efrat Efron and Ruth David. (2018). *Writing the Literature Review : A Practical Guide*. 1st Edition, Guilford Press . ISBN 978-1462536894 .


## E-R ESOURCES

1. IEEE Open Access Articles
2. Science Direct Open Access E-Journals
3. ASME Digital Collections
4. ASCE (American Society for Civil Engineers)
5. CSIR-NISCAIR E- journals
6. Spriger Open Access E-Journals & E-Journals
7. Shodh Gangotri (Repository of Indian Research in Progress)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEEREING** | **COURSE NAME** | Internship (Technical) |
| | **COURSE CODE** | 2304396L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | NIL | 75 | 75 |

**PRE-REQUISITE :** Knowledge about the communication skills

**COURSE OBJECTIVES :**

2304396.CEO.1: To enhance technical skills and self-directed learning.

2304396.CEO.2: To develop adaptability and resilience in a multicultural or professional environment.

2304396.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2304396.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2304396.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304396.CO.1: Apply technical competencies gained through hands-on training or certification programs to solve discipline-specific engineering problems [L3].

2304396.CO.2: Develop professional behavior by demonstrating teamwork, time management, and ethical practices in technical and industrial environments [L5].

2304396.CO.3: Evaluate personal and professional growth through critical analysis of experiential learning and industry training outcomes to support career planning [L5].

2304396.CO.4: Formulate strategies addressing emerging industry needs by integrating advanced technical skills with real-world insights [L4].

2304396.CO.5: Propose solution-oriented approaches to complex problems using multidisciplinary knowledge and practical exposure [L5].

2304396.CO.6: Design and deliver technical presentations and detailed reports that effectively communicate practical insights and certifications to varied audiences [L5].

**INTRODUCTION:**

This internship is designed to equip third year entrants B.Tech. students with essential skills for personal and professional growth. The program emphasizes cultivating professionalism, technical expertise, and real-world problem-solving capabilities, enabling students to thrive in competitive and dynamic landscape. Through this immersive experience, students will develop a comprehensive skill set that includes technical knowledge applied through real-time projects, effective communication, teamwork, and adaptability.

A significant focus of the program is encouraging students to pursue technical certifications in core and emerging domains, thereby enhancing their technical competence and industry readiness. These certifications include, but are not limited to:

- **Programming and Development:** Java, Python, C++, and Advanced Java.
- **Database Management:** Oracle, SQL, and MongoDB.
- **Engineering Design and Simulation:** Autodesk Revit, MATLAB, ANSYS, and AutoCAD.
- **Process Simulation and Optimization:** Aspen HYSYS, Aspen Plus, and CFD (Computational Fluid Dynamics).
- **Data Analytics and Visualization:** Power BI, Tableau, and Excel Advanced Analytics.
- **Cloud Computing and Automation:** AWS (Amazon Web Services), Microsoft Azure, and DevOps Essentials.
- **AI and Machine Learning:** TensorFlow, PyTorch, and introductory courses in AI/ML applications.
- **Digital Tools for Productivity:** Primavera P6 for project management and SolidWorks for design engineering.

By participating in this internship, students will gain hands-on experience in their chosen technical areas, actively apply theoretical knowledge to practical challenges, and build confidence in delivering solutions. The program also emphasizes collaboration and peer learning, helping students to develop essential teamwork skills.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the third year of the B.Tech. program, to be undertaken during the summer break after Semester IV. This program aims to provide opportunities for skill enhancement through global certifications, technical skills training, or industrial exposure. The internship focuses on helping students identify and engage with relevant learning platforms, small-scale industries, or training opportunities to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

- **Duration:** : 3 to 4 weeks (minimum of 100 hours).
- **Timeframe:** Conducted during June-July of each academic year.
- **Nature of Internship:**

1. Technical skills training programs.
2. Industrial training with companies or small-scale industries.
3. Certifications in core technical fields such as programming, database management, design, simulation, and data analysis.

- **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.
- **Mentorship:** Each second-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development.

**Student Development Focus :**

Before selecting an internship option, second-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. The program places significant emphasis on pursuing technical certification programs in areas such as programming, database management, engineering design, simulation, data analytics, and more. These certifications will enhance students' technical expertise and provide them with a competitive edge in the industry, preparing them for future academic and career success.

Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

---

**1. Continuous Assessment (CA): Biweekly Progress Reports and interaction with faculty mentor (40%):**

Students must submit at least two progress reports during the internship/training period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them

**2. Detailed Project Report with Learning Outcomes (30%)**

Upon completion of the internship, students are required to submit a comprehensive minimum of 20 to 25 pages' internship/project report. The report must include:

1. Overview of the Industry/Research Institute
2. Skills and knowledge acquired (technical/soft/life)
3. Specific challenges addressed
4. Personal and professional growth reflections
5. Clearly stated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certiftcate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | SOFTWARE ENGINEERING |
| | COURSE CODE | 2304313T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Prototyping

**COURSE OBJECTIVES :**

2304313T.CEO.1: To explore the software process models.
2304313T.CEO.2: To process requirement engineering and modeling for product development.
2304313T.CEO.3: To estimate and manage software metrics.
2304313T.CEO.4: To understand the test driven environment in software development.
2304313T.CEO.5: To illustrate DevOps lifecycle and different tools

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304313T.CO.1: Classify SDLC process models.[L4]
2304313T.CO.2: Analyze conformance of the requirement and modeling related to project development.[L4]
2304313T.CO.3: Apply mitigation techniques for the risk associated with project development.[L3]
2304313T.CO.4: Evaluate the schedule, cost and staff associated with project. [L5]
2304313T.CO.5: Apply different DevOps tools for project development. [L3]

**COURSE ABSTRACT:**

The Software Engineering course provide preparation for careers in system development, project management, and quality assurance with cutting-edge tools and methodologies. Enhance technical skills and problem-solving abilities essential for top tech roles.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Basics of Software Engineering** | **08 HOURS** |

**Applications/Case Study:** Learning Game Design and Software Engineering through a Game Prototyping Experience

**Contents:** Generic process model: Process framework, umbrella activities, Process Adaptation, Perspective Process Models - Waterfall Model, Prototyping, Incremental, and Agile Process Model: XP and Scrum, introduction to Principles of framework Activities, DevOps concepts and process

**Self Study:** Component based development process model.

**Further Readings:** Dynamic System Development Method.

| | | |
|---|---|---|
| **UNIT 2** | **Requirement Analysis and Modelling** | **09 HOURS** |

**Applications/Case Study:** Online Marketing Software Platform

**Contents:** Requirement Engineering, Scenario based requirement modeling, Class based requirement modeling, Behavior based requirement modeling, Requirement modeling for web and mobile apps, Design Concepts, Design models, Architectural design, Static and Dynamic UML Diagrams: Class diagram, Object diagram, Use case, Activity diagram, Sequence diagram, Block diagram, Architectural diagram and Deployment diagram

**Self Study:**Interaction Model for Web and Mobile Apps

**Further Readings:**Configuration Models for Web Apps.

| | | |
|---|---|---|
| **UNIT 3** | **Process Management and Estimation** | **08 HOURS** |

**Applications/Case Study:** Successful Application of Software Reliability by Norman F. Chneidewind

**Contents:** Software Configuration Management, Software Project Planning: Project Planning objectives, Software Metrics: Size, Function Point, Staffing, Project Estimation Methods Decomposition Techniques, Empirical Estimation Models COCOMO Model, Risk Management: Risk Identification, Analysis, mitigation methods

**Self Study:** Software Quality ISO Standards

**Further Readings:**ISO/IEC 9126 Software engineering

| | | |
|---|---|---|
| **UNIT 4** | **Test Driven Development** | **08 HOURS** |

**Applications/Case Study:** Manual Testing (Online Marketing Software Platform)

**Contents:** System Testing - System Integration Techniques - Incremental, Top-Down Bottom, White box Testing, Black box Testing, Performance Testing, Security Testing, Acceptance testing

**Self Study:** Automated Testing life cycle

**Further Readings:**Software Reliability

| UNIT 5 | DevOps and Automation | 12 HOURS |
|---|---|---|

**Applications/Case Study:** Maven and Puppet

**Contents:**Introduction to DevOps life cycle, DevOps tools, Version Control System, GIT, Continuous Integration, Jenkin, Containerizing the applications, Docker life cycle, Docker commands, Kubernetes components, Kubernetes master slave architecture, Namespace, Application deployment in kubernetes cluster, Configuration management, Ansible architecture, Setting up master slave using ansible, Ansible playbook, Roles, Configurations using ansible, continuous monitoring, Nagios, Nagios Architecture, Nagios commands, Nagios plugins, Nagios notification

**Self Study:** GCP Cloud Computing and Storage in DevOps

**Further Readings:** Appdynamics

## TEXT BOOKS


1. Roger Pressman(2023), *"Software Engineering: A Practitioner's Approach"*, McGraw-Hill Education; . 9th Edition, ISBN 13: 978-9355325044
2. Ian Somerville (2018), *"Software Engineering"* Pearson Publication; 9th edition, ISBN-13: 978-0-13- 703515-1
3. Srinivasan Desikan (2007),*" Software Testing Principals and practices"*, Pearson Publication, ISBN-13 978- 8-17-758295-6


## REFERENCE BOOKS


1. Kshirasagar Nak, Priyadarshi Tripathy(2008), *"Software Testing and Quality Assurance-Theory and Practice "*, John Wiley Sons Inc
2. Jeff Tian, John Wiley(2005) *"Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement "*, Jeff Tian, John Wiley Sons, Inc., Hoboken, New Jersey.


## E-R ESOURCES

1. https://nptel.ac.in/courses/106105182

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | SOFTWARE ENGINEERING LAB |
| | COURSE CODE | 2304313L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :**

Prototyping

**COURSE OBJECTIVES :**

2304313L.CEO.1: To explore the software process model.
2304313L.CEO.2: To process requirement engineering and modeling for product development.
2304313L.CEO.3: To estimate and manage software metrics.
2304313L.CEO.4: To understand the test driven environment in software development.
2304313L.CEO.5: To illustrate DevOps lifecycle and different tools.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304313L.CO.1: Analyze conformance of the requirement and modeling related to project development.[L4]
2304313L.CO.2: Apply mitigation techniques for the risk associated with project development. [L3]
2304313L.CO.3: Demonstrate the usage of tools for project development phases. [L3]

**COURSE ABSTRACT:**

The Software Engineering course provide preparation for careers in system development, project management, and quality assurance with cutting-edge tools and methodologies. Enhance technical skills and problem-solving abilities essential for top tech roles.

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **A. Students are required to take a real-life scenario for software development (ERP, Mobile app, IoT project) and apply a correct Development paradigm for it with justiftcation.**<br><br>**OR**<br><br>**Students can take mini or minor project/ DBMS project / DSF Project and explain which software development paradigm was used, what were the limitations of that paradigm. Students should propose a revised paradigm to overcome the limitations of existing one with justiftcation.**<br>**B. For the project, make a SRS in IEEE format.** | **6 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.02** | **Take your problem statement and design modelling using UML Diagrams.** | **4 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.03** | **Prepare a suitable cost estimation model, WBS, Gantt chart (using MS project tool) and all necessary estimation for your project.** | **4 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.04** | **Prepare the risk mitigation plan for the selected project.** | **4 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.05** | **Design test driven process for project based on associated risk and possible threats.** | **4 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.06** | **Use and demonstration of any two Devops tools for the project.** | **4 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.07** | **Final presentation: Report and PPT** | **4 HOURS** |
| Further practice: NIL | | |

## TEXT BOOKS


1. Joakim Verona (2016), *Practical DevOps* , Packt Publishing Limited, 1$^{ed}$ Edition,O'Reilly Media Inc, ISBN-13 978-9352133765
2. Jennifer Davis Ryn Daniels, (2017) *Jenkins Essentials*. 2$^{ed}$ edition, Packt Publishing Limited, ISBN-13 978-1783553471


## REFERENCE BOOKS


1. Mitesh Soni (2017). *Jenkins Essentials*. 2$^{ed}$ Edition , Packt Publishing Limited, ISBN-13 978-1783553471


## E-RESOURCES

1. https://nptel.ac.in/courses/106105182

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | DESIGN AND ANALYSIS OF ALGORITHMS |
| | COURSE CODE | 2304314T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :**

Calculus and differential equation, Foundation of Computing

**COURSE OBJECTIVES :**

2304314T.CEO.1: To develop problem solving abilities using mathematical theories.
2304314T.CEO.2: To apply algorithmic strategies while solving problems.
2304314T.CEO.3: To analyze performance of different algorithmic strategies in terms of time.
2304314T.CEO.4: To distinguish between P and NP class of problems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304314T.CO.1: Analyze the given algorithm in terms of its computational complexity. [L4].
2304314T.CO.2: Apply algorithmic strategies to solve given problems. [L3].
2304314T.CO.3: Find optimal solution by applying various methods. [L3].
2304314T.CO.4: Solve intractable problem by using approximation algorithm. [L3].
2304314T.CO.5: Make use of string matching algorithm to find matches between specified pattern. [L3].

**COURSE ABSTRACT:**

This course introduces the mathematical notion of algorithms and teaches how to develop, validate, and optimize them for performance and memory. The course includes a significant mathematics component, as well as the design of various algorithms.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION OF ALGORITHMIC STRATEGY** | **08 HOURS** |

**Applications/Case Study:** Packet switched network, Binary Search.
**Contents:** Algorithm, performance analysis, Need of Algorithm,Asymptotic Notation, Problem solving strategies Divide and Conquer: Basic method, Example: Quick Sort, Max-Min Problem, Large integer multiplication algorithm, Recurrence: Substitution method, Master Theorem.
**Self Study:** Median of Two sorted arrays of same size.
**Further Readings:** Strassen's Matrix Multiplication.

| | | |
|---|---|---|
| **UNIT 2** | **GREEDY METHOD** | **06 HOURS** |

**Applications/Case Study:** CPU Scheduling Algorithms, Network Routing
**Contents:** Greedy Algorithm: Basic Method and Algorithms, Example: Fractional Knapsack Problem, Job Sequencing with Deadline, Huffman Algorithm, Activity Selection Problem.
**Self Study:**Coin Changing Problem
**Further Readings:**Task scheduling problem as a matroid.

| | | |
|---|---|---|
| **UNIT 3** | **DYNAMIC PROGRAMMING** | **08 HOURS** |

**Applications/Case Study:** Google Map, Google search engine
**Contents:** Dynamic Programming: Basic Method, Example: 0/1 Knapsack, Chain Matrix Multiplication OBST, All pairs shortest path, Floyd-Warshall's Algorithm, Travelling Salesman Problem.
**Self Study:** Coin changing problem.
**Further Readings:**Longest common Subsequence Problem.Single source shortest path: Bellman Ford algorithm.

| | | |
|---|---|---|
| **UNIT 4** | **BACKTRACKING AND BRANCH AND BOUND** | **08 HOURS** |

**Applications/Case Study:** Parser, Crossword puzzle, Sudoku.
**Contents:** Backtracking: Basic Method, Examples: Eight Queen Problem, Sum of Subset problem,Branch and Bound: Basic Method, FIFO and LC approach, 0/1 knapsack problem using FIFO LC Approach, Traveling Salesperson problem FIFO LC Approach
**Self Study:** Backtracking Algorithms for Enumerating Independent Sets of a Graph.
**Further Readings:**15 Puzzle problem.

| UNIT 5 | COMPUTATIONAL COMPLEXITY THEORY | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Airline crew scheduling, TSP and Graph coloring problem.

**Contents:** Classifying Problems, Nondeterministic Deterministic problems, Tractable Non Tractable problems, Reductions, Cook's Theorem, NP-Complete problem, NP-Hard problem,3SAT Problem Approximation algorithm: vertex cover problem.

**Self Study:** Approximation algorithm for TSP.

**Further Readings:** Clique Decision problem.

| UNIT 6 | ADVANCED ALGORITHMS AND APPLICATIONS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** plagiarism detector, spell checker, web search engines

**Contents:** Randomized algorithms : Monte Carlo and Las Vegas algorithm, String matching algorithm: KMP, Boyer Moore Algorithm, Robin Karp Algorithm, Number theoretic algorithm: : the GCD – Modular Arithmetic – The Chinese Remainder Theorem.

**Self Study:** Na¨ıve string matching algorithm.

**Further Readings:** The general string problem as a finite automata.

## TEXT BOOKS


1. E.Horowitz , S. Sahni, S. Rajasekaran (2008) *Fundamentals of Computer Algorithms*. 2nd Edition, Universities Press pvt Ltd ,ISBN 9788173716126.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein (2022) *Introduction to Algorithm*. 4th edition, Cambridge, Massachusetts : The MIT Press, ISBN 9780262367509.
3. Anany Levitin *Introduction to the Design and Analysis of Algorithms*. 3rd edition,ISBN: 9780132316811.


## REFERENCE BOOKS


1. V. Aho , J.D. Ullman,(2002) *Design and Analysis of Computer Algorithms*. 1st Edition , Pearson Education , ISBN 8131702057 PHI Learning Pvt Ltd, 2011, ISBN 978-81-203-40007-7.
2. Brassard G. and Bratley P. *Algorithms, Theory and Practices*. 1st Edition , PHI. ISBN 0-13-023243-2.


## E-R ESOURCES

1. https://nptel.ac.in/courses/106101060

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | DESIGN AND ANALYSIS OF ALGORITHMS LAB |
| | COURSE CODE | 2304314L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :**

Calculus and differential equation, Foundation of Computing

**COURSE OBJECTIVES :**

2304314L.CEO.1: To design an efficient algorithm for any specified problem.
2304314L.CEO.2: To carry out the analysis of various algorithms in terms of its computational complexity.
2304314L.CEO.3: To identify appropriate algorithmic design strategies to optimize the performance of a given problem.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304314L.CO.1: Design algorithms using appropriate design Techniques [L3].
2304314L.CO.2: Implement a variety of algorithms in a high level language. [L3]
2304314L.CO.3: Apply and implement learned algorithm design techniques to solve real-world problems.[L3].
2304314L.CO.4: Analyze algorithms to deduce their time complexities. [L5].

**COURSE ABSTRACT:**

This course introduces the mathematical notion of algorithms and teaches how to develop, validate, and optimize them for performance and memory. The course includes a significant mathematics component, as well as the design of various algorithms.

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **Design and implement various application of divide and conquer approach.** | **4 HOURS** |
| Further practice: Strassen's Matrix Multiplication | | |
| **PRACTICAL NO.02** | **write a program to solve application using Greedy Approach. Calculate the time complexity of the algorithm.** | **4 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.03** | **Design and implement problem using dynamic approach.Calculate the time complexity of the algorithm.** | **6 HOURS** |
| Further practice: Coin Changing | | |
| **PRACTICAL NO.04** | **Write a program to solve application of branch and bound approach.** | **4 HOURS** |
| Further practice: Sum of Subset | | |
| **PRACTICAL NO.05** | **Design and Implement application based on backtracking approach.** | **4 HOURS** |
| Further practice: Graph coloring | | |
| **PRACTICAL NO.06** | **Design and Implement the string matching algorithm.** | **4 HOURS** |
| Further practice: Rabin Karp | | |
| **PRACTICAL NO.07** | **Design and Implement randomized algorithms.** | **4 HOURS** |
| Further practice: Quick Sort | | |

## TEXT BOOKS


1. E.Horowitz , S. Sahni, S. Rajasekaran (2008). *Fundamentals of ComputerAlgorithms.* $2^{nd}$ Edition, Universities Press pvt Ltd , ISBN 9788173716126.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein (2022) *Introduction to Algorithm.* $4^{th}$ edition, Cambridge, Massachusetts : The MIT Press, ISBN 9780262367509.


## REFERENCE BOOKS


1. V. Aho , J.D. Ullman (2002). *Design and Analysis of Computer Algorithms.* $1^{st}$ Edition , Pearson Education 2002, ISBN 8131702057 PHI Learning Pvt Ltd, 2011, ISBN 978-81-203-40007-7.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | PREDICTIVE ANALYTICS |
| | **COURSE CODE** | 2304326T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Descriptive Analytics

**COURSE OBJECTIVES :**

2304326T.CEO.1: To summarize the Supervised Learning Methods.
2304326T.CEO.2: To understand the advanced classification techniques.
2304326T.CEO.3: To explain Artificial Neural Network.
2304326T.CEO.4: To understand Clustering Techniques.
2304326T.CEO.5: To understand Deep learning and Natural Language Processing.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304326T.CO.1: Apply the classification and prediction techniques to solve real world problems[L3[.
2304326T.CO.2: Use advanced classification techniques[L3].
2304326T.CO.3: Apply artificial neural network (ANN) for implementing Deep Learning models[L3].
2304326T.CO.4: Implement different clustering techniques[L3[.
2304326T.CO.5: Implement different ensemble learning techniques[L3].
2304326T.CO.6: Solve real world problems using deep learning models and NLP [L3].

**COURSE ABSTRACT:**

Predictive analytics is a powerful field that leverages data science to make informed decisions, anticipate future trends, and optimize strategies across various domains. This comprehensive course delves into advanced predictive analytics methodologies, equipping participants with the knowledge and skills necessary to extract actionable insights from data.Throughout the course, participants will explore cutting-edge techniques including advanced classification, artificial neural networks (ANNs), deep neural networks (DNNs), Ensemble Learning methods, clustering techniques, and ensemble techniques.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **CLASSIFICATION AND PREDICTIONS** | **08 HOURS** |

**Applications/Case Study:** House price prediction Case

**Contents:** Classification and Prediction, Decision Tree-Based Classification-(c.4.5), Probabilistic Classification: Naive Bays Classification, Bayesian Belief Network (BBN), Eager Learning, Lazy Learning, K-Nearest neighbor- KNN. Support Vector Machine (SVM), Soft Versus Hard Margin, Local and Global Minima,

**Self Study:** Classification Assessment

**Further Readings:** A fast Scalable Classifier for Data mining

| | | |
|---|---|---|
| **UNIT 2** | **CLUSTERING TECHNIQUES** | **06 HOURS** |

**Applications/Case Study:** Online Shopping Case Study

**Contents:** Basics of Clustering, Quality Parameters of Clustering, Various Clustering Approaches. Partitioning Methods: K-Means, K-Medoids (Partition Around Medoids), Hierarchical Methods: Agglomerative and Divisible Clustering. Expectation Maximiza- tion (EM) Algorithm, Discussion On EM.

**Self Study:** Spectral Clustering.

**Further Readings:** Graph Clustering.

| | | |
|---|---|---|
| **UNIT 3** | **ARTIFICIAL NEURAL NETWORK** | **08 HOURS** |

**Applications/Case Study:** Automatic car Case Study

**Contents:** Artificial Neural Network (ANN): Neurons, perceptron, parameter settings of ANN, Topologies of ANN, transfer functions, learnings in ANN, Activation functions, Learning rate, Gradient descent, Back- Propagation, Basic forms of Neural processing, Advantages and Limitations of ANN. Introduction to deep learning , Deep learning models.

**Self Study:** Convolutional Neural Networks.

**Further Readings:** Deep Architecture.

| UNIT 4 | NATURAL LANGUAGE PROCESSING (NLP) | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Social media Anallytics

**Contents:** NLP Introduction, Part of S Tagging, Part Of Speech tagging approaches: HMM for POS. A large language model (LLM) introduction, Training and working of LLM. Applications of LLM using case study.

**Self Study:** NLP- Stop word removal, Stemming, lemmatization,topic modeling

**Further Readings:** Fine tuning of LLM

| UNIT 5 | DEEP LEARNING | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Disease Classification Using CNN.

**Contents:** CNN architecture overview, The Basic Structure of a Convolutional Network- Padding, Strides, Typical Settings, the ReLU layer, Pooling, Fully Connected Layers, Training a Convolutional Network. Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder, The Challenge of Long-Term Dependencies, The Long Short-Term Memory. Design neural network architectures for new data problems based on their requirements and problem characteristics, and analyze their performance.

**Self Study:** Long Short-Term Memory Networks (LSTMs)

**Further Readings:** Fine Tuning RNN Models

| UNIT 6 | GENERATIVE ADVERSARIAL NETWORKS | 07 HOURS |
|---|---|---|

**Applications/Case Study:** FaceAPP

**Contents:** Introduction to Generative Models, working principle of GAN, Role of the discriminator, generator, Mode Collapse and Problems with BCE Loss , Training vs. Inference, Earth Mover's Distance (Wasserstein Distance), Wasserstein-Loss, Condition on W-loss Critic, 1-Lipschitz Continuity Enforcement..

**Self Study:** DCGANs

**Further Readings:** CycleGAN for image translation

## TEXT BOOKS


1. Murrey R Spiegal, Larry Stifens, "Statistics" , 5th edition ,Schaum's Series, McGraw-Hill Education; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527
2. Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.
3. Alpaydin, E. (2010). Introduction to Machine Learning. MIT Press.
4. François Chollet, Deep Learning with Python, Manning Publications.
5. Stefano van der Walt and Sharon Zhou, Hands-On Generative Adversarial Networks with PyTorch 1.x: Implement next-generation neural networks to build powerful GAN models using Python, Packt Publishing.

## REFERENCE BOOKS


1. Murrey R Spiegal, Larry Stifens, "Statistics" , 5th edition ,Schaum's Series, McGraw-Hill Education; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527
2. Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.
3. Alpaydin, E. (2010). Introduction to Machine Learning. MIT Press.
4. Francois Chollet, Deep Learning with Python, Manning Publications.
5. Stefano van der Walt and Sharon Zhou, Hands-On Generative Adversarial Networks with PyTorch 1.x: Implement next-generation neural networks to build powerful GAN models using Python, Packt Publishing.
6. Daniel Jurafsky and James H. Martin, Speech and Language Processing, Person Publication


## E-RESOURCES

1. https://doi.org/10.1145/3234150
2. https://www.sciencedirect.com/science/article/pii/S1574013721000198?via
3. https://ieeexplore.ieee.org/document/10193469/
4. https://doi.org/10.1007/s40745-015-0040-1

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | PREDICTIVE ANALYTICS LAB |
| | **COURSE CODE** | 2304326L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Descriptive Analytics

**COURSE OBJECTIVES :**

2304326L.CEO.1: To understand the advanced classification techniques.
2304326L.CEO.2: To use the basic terminology of artificial neural networks.
2304326L.CEO.3: To understand the deep neural networks..
2304326L.CEO.4: To illustrate the unsupervised learning methods.
2304326L.CEO.5: To explain basic terminology of natural language processing.
2304326L.CEO.6: To explain ensemble learning.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304326L.CO.1: Apply predictive analytics techniques to solve a given problems. [L3]
2304326L.CO.2: Select efficient analytics techniques for multimedia dataset.[L3].
2304326L.CO.3: Infer from the survey of existing preditive algorithms and methods.[L4]
2304326L.CO.4: Create an application to solve any real world problem using appropriate predictive analytics techniques.[L6]

**COURSE ABSTRACT:**

Predictive analytics is a powerful field that leverages data science to make informed decisions, anticipate future trends, and optimize strategies across various domains. This comprehensive course delves into advanced predictive analytics methodologies, equipping participants with the knowledge and skills necessary to extract actionable insights from data.Throughout the course, participants will explore cutting-edge techniques including advanced classification, artificial neural networks (ANNs), deep neural networks (DNNs), Ensemble Learning methods, clustering techniques, and ensemble techniques

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Implementation of classiftcation algorithms (any two ) (Naïve bays, BBN, KNN, CART,SVM etc)** | **4 HOURS** |
| Further practice: Develop a application using any front end tool to use classification algorithm, | | |
| **PRACTICAL NO.02** | **Problem solving using clustering algorithm** | **4 HOURS** |
| Further practice: Implement any one advance clustering techniques. | | |
| **PRACTICAL NO.03** | **Deep learning applications for given case study.** | **4 HOURS** |
| Apply hypertunning paramter to increase the accuracy of deep neural netwok | | |
| **PRACTICAL NO.04** | **Application of Hidden Markov Model for solving problem of natural language processing.** | **4 HOURS** |
| Further practice: Student has to apply for HMM for Part of Speech problem. | | |
| **PRACTICAL NO.05** | **Apply Adversarial Neural Network** | **4 HOURS** |
| Further practice: Evaluate the performance analysis. | | |
| **PRACTICAL NO.06** | **Mini Project** | **10 HOURS** |
| Data science solution for real word problems – project ( group 3 ) duration 1 month ( Problems include image processing, video processing will be preferred) Real life problem statements from associated industries will be shared with students and assessment will be done with the help of industry experts. These problems would cover all branches of engineering. The project includes survey of existing model. Finding researh gap and providing methods/idea for improvement. Implementation of Methods/Ideas. Inference from the experimentation. | | |

## TEXT BOOKS


1. Murrey R Spiegal, Larry Stifens, "Statistics" , 5th edition ,Schaum's Series, McGraw-Hill Education; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527
2. Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.
3. Alpaydin, E. (2010). Introduction to Machine Learning. MIT Press.
4. Francois Chollet, Deep Learning with Python, Manning Publications.
5. Stefano van der Walt and Sharon Zhou, Hands-On Generative Adversarial Networks with PyTorch 1.x: Implement next-generation neural networks to build powerful GAN models using Python, Packt Publishing.


## REFERENCE BOOKS


1. Murrey R Spiegal, Larry Stifens, "Statistics" , 5th edition ,Schaum's Series, McGraw-Hill Education; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527
2. Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.
3. Alpaydin, E. (2010). Introduction to Machine Learning. MIT Press.
4. Francois Chollet, Deep Learning with Python, Manning Publications.
5. Stefano van der Walt and Sharon Zhou, Hands-On Generative Adversarial Networks with PyTorch 1.x: Implement next-generation neural networks to build powerful GAN models using Python, Packt Publishing.
6. Daniel Jurafsky and James H. Martin, Speech and Language Processing, Person Publication


## E-RESOURCES

1. https://doi.org/10.1145/3234150
2. https://www.sciencedirect.com/science/article/pii/S1574013721000198?via
3. https://ieeexplore.ieee.org/document/10193469/
4. https://doi.org/10.1007/s40745-015-0040-1

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | DEEP LEARNING |
| | COURSE CODE | 2304327T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Statistics and Integral Calculus, Artificial Intelligence and Machine learning

**COURSE OBJECTIVES :**

2304327T.CEO.1: Develop a comprehensive understanding of the mathematical foundation of neural network employed on static and dynamic data set.

2304327T.CEO.2: Apply algorithms to solve real-world problems in computer vision, natural language processing, and other domains.

2304327T.CEO.3: To analyze the performance of various approaches of deep learning algorithms.

2304327T.CEO.4: Handle techniques for evaluating and fine-tuning model performance.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304327T.CO.1: Model the mathematical intuition of underlying neural networks for its application to both static and dynamic datasets[L3].

2304327T.CO.2: Apply relevant deep learning algorithms to develop intelligent systems in various real world domains[L3]

2304327T.CO.3: Evaluates the performance of intelligent models using various evaluation techniques and metrics[L5].

2304327T.CO.4: Fine-tune hyper-parameters to optimize intelligent models[L4].

2304327T.CO.5: Analyse the relative advantages and limitations of various deep learning algorithms[L5].

**COURSE ABSTRACT:**

This course explores deep learning in artificial intelligence, covering its fundamental principles, methodologies, and practical applications. It covers neural networks, convolutional and recurrent neural networks, and their applications in image classification, object detection, segmentation, natural language processing, and time series analysis. The course also covers reinforcement learning and transfer learning techniques. The course emphasizes both theoretical understanding and practical implementation, combining lectures with hands-on exercises and projects. Students gain a comprehensive understanding of deep learning concepts and skills in applying these techniques to real-world datasets and challenges. This equips students with the knowledge and proficiency to contribute to AI-driven solutions across various industries.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Fundamental of Neural network** | **07 HOURS** |

**Applications/Case Study:** Customer Engagement

**Contents:**Neural Network Contents: Neural Network: Introduction to Neural Networks, Fundamental Concepts: Neuron Models And Basic Learning Rules, Perceptron Training Rule, Gradient Descent And Delta Rule, Back- Propagation Algorithm,Loss Functions, Multi layer Network,Regularization techniques.

**Self Study:** Activation Function

**Further Readings:** Optimization Algorithms

| | | |
|---|---|---|
| **UNIT 2** | **Deep Convolutional Neural network** | **08 HOURS** |

**Applications/Case Study:** Chest X Ray Image Classification

**Contents:**Convolutional Neural Network (CNN)Architecture, Activation Functions, Training and Back-propagation Transfer Learning:Approaches,Pre-trained Models,Fine-tuning and Feature Extraction. Object Detection: Faster R-CNNs, YoLO,evaluation metrics.

**Self Study:**RetinaNet

**Further Readings:**Graph Convolutional Neural Networks

| | | |
|---|---|---|
| **UNIT 3** | **Deep Quantum Computing** | **08 HOURS** |

**Applications/Case Study:** Quantum-enhanced image classification

**Contents:** Quantum Mechanics Foundations,Quantum Gates and Circuits,Quantum Algorithms,Overview of Quantum CNN,Architecture of Quantum CNN, Quantum CNN Operations simulators -IBM's Qiskit, PennyLane, or Google's Cirq.

**Self Study:** Quantum Error Correction

**Further Readings:**Quantum Hardware

| UNIT 4 | Time Series Analysis | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Marketing and Customer Analytics

**Contents:** Time Series Data,Time Series Decomposition Statistical Models:Autoregressive Integrated Moving Average (ARIMA), Forecasting Techniques, Sequence Model,Understanding sequential data,Types of sequence models,Hidden Morkow Model,Recurrent Neural Network,Vanishing gradient Problem,Long Short term Memory,Gated Recurrent Unit,mathematical modeling of behind sequence model.

**Self Study:** Seasonal Decomposition of Time Series (STL)

**Further Readings:**Stochastic recurrent neural network

| UNIT 5 | Sequence to Sequence Models | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Text Summarization and Machine Translation

**Contents:**Overview of Natural language processing, Introduction to Seq2Seq models,Encoder-Decoder Architecture,Attention Mechanism, Transformer-based Seq2Seq Models: Introduction of transformer architecture and self-attention mechanisms for parallelized computation,Handling Variable-Length Sequences,Evaluation Metrics: BLEU for machine translation and ROUGE for summarization.

**Self Study:** Teacher Forcing,Beam Search

**Further Readings:** Fine-tuning encoder and decoder

| UNIT 6 | Explainable AI | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Interpreting Diabetes Risk Predictions.

**Contents:** Introduction to Explainable AI,Model-Specific, Model-Agnostic:LIME (Local Interpretable Model-agnostic Explanations): Approximating models with simple interpretable ones. SHAP (SHapley Additive exPlanations).

**Self Study:**Trends in research (causality in XAI, human-centered AI). The role of XAI in AI governance and regulation.

**Further Readings:** Ethical considerations: Bias, fairness, and regulatory compliance (GDPR, etc.)

## TEXT BOOKS


1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016). *Deep Learning*. 1st Edition, The MIT Press . ISBN 978-0262035613.
2. Aurélien Géron(2019) *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition*. 1st Edition,Packt Publishing. ISBN 9781492032649.


## REFERENCE BOOKS


1. Maxim Lapan.(2018).*Deep Reinforcement Learning Hands-On*Packt Publishing. ISBN 978-1788834247
2. Seth Weidman.(2019).*Deep Reinforcement Learning Hands-On*Packt Publishing. ISBN 978-1788834247


## E-BOOKS/E-CONTENTS LINKS

1. Dive into Deep Learning:Aston Zhang, Zachary C. Lipton, Mu Li, And Alexander J.Smola. (2024). *Dive into Deep Learning* Paperback. ISBN 1009389432. link- https://d2l.ai/d2l-en.pdf
2. https://developer.nvidia.com/deep-learning
3. https://builtin.com/machine-learning/deep-learning
4. https://www.deeplearningbook.org/

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | DEEP LEARNING LAB |
| | COURSE CODE | 2304327L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Statistics and Integral Calculus, Artificial Intelligence and Machine learning

**COURSE OBJECTIVES :**

2304327L.CEO.1: Develop hands-on skills to implement and train deep learning models using popular frameworks.
2304327L.CEO.2: Identify problems that can be effectively addressed using deep learning solutions.
2304327L.CEO.3: Evaluate the performance of deep learning models using evaluation metrics.
2304327L.CEO.4: Assess the strengths and limitations of different deep learning approaches.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304327L.CO.1: Develop critical thinking skills by solving real-world problems using deep learning algorithm.[L4]
2304327L.CO.2: Investigate strategies for improved model generalization, reducing overfitting, enhancing unseen performance.[L4]
2304327L.CO.3: Optimize models by fine-tuning hyperparameters for task-specific and dataset-specific optimal performance.[L5]
2304327L.CO.4: Discuss results to draw conclusions on problem-solving method effectiveness.[L5]
2304327L.CO.5: Improve collaboration through group discussions, sharing insights, and contributing to DL projects in lab settings. [L5]

**COURSE ABSTRACT:**

This course explores deep learning in artificial intelligence, covering its principles, methodologies, and practical applications. Students will learn about neural networks, convolutional neural networks, and recurrent neural networks, and their roles in tasks like image classification, object detection, segmentation, natural language processing, and time series analysis. The course combines theoretical understanding with practical implementation through lectures, exercises, and projects. Lab components include hands-on exercises, project-based assignments, experimentation with pre-trained models, and integration with web applications. Students will gain a comprehensive understanding of deep learning principles and methodologies.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Neural Networks design and deployment** | **4 HOURS** |

1. Model Development: Design and train the neural network with appropriate architecture, loss function, optimizer, and data handling techniques, ensuring model accuracy and performance through evaluation and hyperparameter tuning.

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Transfer Learning** | **6 HOURS** |

1. Transfer Learning Model Development: Fine-tune a pre-trained model on your specific dataset, adjusting the top layers and optimizing hyperparameters to achieve desired performance metrics.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Object Detection and Multi object classiftcation** | **4 HOURS** |

1. Dataset Preparation and Model Design: Select and preprocess a dataset with annotations for object detection, segmentation masks, and class labels. Design a deep learning architecture that integrates object detection, segmentation, and recognition tasks.
2. Model Training and Optimization: Train the multi-task model, experiment with hyperparameters, and fine-tune using transfer learning. Implement optimization techniques to enhance performance.
3. Evaluation and Visualization: Evaluate the model on a test dataset, create visualizations of predictions, and discuss challenges and potential real-world applications.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Natural Language Processing** | **4 HOURS** |

1. Data Preparation: Obtain a dataset with sentiment labels, clean the data using NLP tools, and visualize sentiment distribution.
2. Text Representation and Model Training: Convert text to numerical vectors using TF-IDF or word embeddings, implement a baseline model, and split the dataset into training and testing sets.
3. Evaluation and Conclusion: Evaluate models on the test set using relevant metrics, summarize key findings, suggest improvements, and recommend future research directions.

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **Sequence Classiftcation** | **4 HOURS** |

1. Development: Design and train a deep sequence model (e.g., RNN, LSTM, GRU, Transformer) using a suitable dataset for sequence classification tasks, ensuring to preprocess the data appropriately and tune hyperparameters for optimal performance.
2. Evaluation: Validate the model's performance on a separate test set, using metrics like accuracy, precision, recall, and F1-score to assess its effectiveness in classifying sequences accurately.

| PRACTICAL NO.06 | Sequence Generation | 6 HOURS |
|---|---|---|

1. Model Design and Training: Construct and train a deep sequential model (e.g., LSTM, GRU, Transformer) on a dataset of sequences, focusing on generating new sequences by learning patterns from the input data.
2. Evaluation and Fine-tuning: Assess the model's ability to generate coherent and relevant sequences by comparing generated sequences against a validation set, and fine-tune the model's parameters to improve generation quality.

| PRACTICAL NO.06 | Mini Project (Object detection/NLP). | 6 HOURS |
|---|---|---|

1. The mini project aims to create a real-time object detection/langauge based web application that uses a pre-trained deep learning model to identify objects in a live webcam feed or dynamic data.
2. The project involves selecting a suitable dataset and model, pre-processing the data, integrating the model, developing the web application, deploying it, and documenting the project.
3. The project will take five weeks, with a maximum of three students participating. The team will prepare a project plan, select a real-time dataset, and select a pre-trained model.
4. The project will also involve data pre-processing, model integration, web application development, deployment, and documentation.
5. Regular communication and collaboration will be maintained throughout the project, with the goal of having a fully functional real-time object detection or NLP web application ready for deployment.

## TEXT BOOKS


1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016). *Deep Learning*. 1st Edition, The MIT Press . ISBN 978-0262035613.
2. Rajalingappaa Shanmugamani(2018) *Deep Learning for Computer Vision*. 1st Edition,Packt Publishing. ISBN 978-1788295628.
3. Aurélien Géron(2019) *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*. 1st Edition,O'Reilly Media. ISBN 978-149203264.


## REFERENCE BOOKS


1. A. B. A. Arriola, J. R. G. de C. Santos, and J. A. de Morais Amado.(2021). *Quantum Neural Networks*,Springer Publishing. ISBN: 978-3030641911
2. Seth Weidman.(2019).*Deep Reinforcement Learning Hands-On*Packt Publishing. ISBN 978-1788834247
3. Parikshit N. Mahalle and Poonam N.(2021) *Explainable AI: Foundations, Applications, and Challenges*, Wiley-Scrivener Publishing. ISBN-13: 978-1119786202


## E-R ESOURCES


1. Dive into Deep Learning:Aston Zhang, Zachary C. Lipton, Mu Li, And Alexander J.Smola.(2024). *Dive into Deep Learning*Paperback. ISBN 1009389432. link- https://d2l.ai/d2l-en.pdf
2. https://developer.nvidia.com/deep-learning
3. https://builtin.com/machine-learning/deep-learning
4. https://www.deeplearningbook.org/
5. https://www.ibm.com/topics/explainable-ai
6. https://research.ibm.com/topics/quantum-machine-learning

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | CLOUD NATIVE APPLICATION DEVELOPMENT |
| | **COURSE CODE** | 2304328T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Data Structures, Database Management Systems, Cloud Computing Foundations

**COURSE OBJECTIVES :**

2304328T.CEO.1: To understand how to program various AWS services using SDK
2304328T.CEO.2: To decide the selection of various database services provided by AWS
2304328T.CEO.3: To learn the concept of Infrastructure as a Code
2304328T.CEO.4: To develop the server less applications

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304328T.CO.1: To choose between server based and serverless services to deploy the application on cloud platform [L3]
2304328T.CO.2: To make use of SDKs to programmatically access the AWS Services [L3]
2304328T.CO.3: To distinguish between protocols for developing own API [L4]
2304328T.CO.4: To select an appropriate configuration for provisioning infrastructure as a code [L5]
2304328T.CO.5: To develop and deploy a web application using various cloud services [L6]

**COURSE ABSTRACT:**

The cloud has transformed our lives as individuals as well. Many of us use cloud services every day. When we update our status on social media, binge a new streaming series, or check our bank accounts we're most likely using applications that are hosted by cloud services. These apps are accessed through an internet connection rather than installed on our hard drives or devices.

The main objective of this course is to learn application development using Amazon AWS cloud provider. Finally, the students must develop an end to end application considering some user requirements by applying front-end and back-end technologies which will be deployed on AWS platform.

**THEORY COURSE CONTENT**

| | | |
|---|---|---|
| **UNIT 1** | **Programming AWS Services** | **7 HOURS** |

**App/System/Case study:** AWS EC2, Amazon S3, Amazon RDS, AWS DynamoDB, AWS IAM

**Contents:** IIntroduction to boto3 module for programming in Python Managing EC2 instances, IAM Operations, VPC Components using Python Programming with AWS RDS, AWS DynamoDB, AWS DocumentDB and AWS Elasticache in Python

**Self Study:** Programming AWS Services using JavaScript

**Further Reading:** AWS LaunchWizard

| | | |
|---|---|---|
| **UNIT 2** | **Provosioning Infrastructure Through Code** | **7 HOURS** |

**App/System/Case study:** Amazon CloudFormation

**Contents:** Cloud Formation concepts, How does Cloud Formation works, , Working with Stacks, Working with Templates, Working with StackSets, Using the Cloud Formation Registry, Logging API Calls, Infrastructure Security, Configuration and vulnerability analysis

Infrastructure provisioning using Terraform

**Self Study:** AWS Lake Formation

**Further Reading:** ArgoCD

| | | |
|---|---|---|
| **UNIT 3** | **AWS Serverless** | **7 HOURS** |

**App/System/Case study:** AWS Lambda, AWS Step Functions

**Contents:** Need for Serverless architecture, How serverless architecture works

Foundations of Lamdba Functions – concepts, features, programming model, architectures, function scaling, Lambda Permissions – Execution role, resource based policies, user policies, Configuration Functions, Managing Functions, Invoking Functions, lambda Functions AWS Step Functions Designing a workflow using AWS Step Functions.

**Self Study:** AWS Lake Formation

**Further Reading:** Writing AWS Lambda Functions in JavaScript

| UNIT 4 | API Development and Management in AWS | 7 HOURS |
|---|---|---|

**App/System/Case study:** Amazon API Gateway

**Contents:** Understanding REST principles, Defining resources and methods

Overview of API Gateway - key features and benefits, creating an API using API Gateway Console, Configuring stages and deployments, Integrating with backend services - Lambda integration, integrating with AWS Services like S3, DynamoDB, API Keys and usage plans, Caching in API Gateway

**Self Study:** WebSocket API

**Further Reading:** Exporting API using OpenAPI Standards

| UNIT 5 | Building CI/CD Pipelines on AWS | 7 HOURS |
|---|---|---|

**App/System/Case study:** Amazon CodeCommit, Amazon CodeBuild, AWS CodeDeploy, AWS CodePipeline

**Contents:** What is CI/CD? CodePipeline concepts, How pipeline execution works, Integration with CodePipeline action types, working with pipelines, working with actions, working with stage transitions, monitoring pipelines, security in pipelines

AWS CodeCommit, AWS CodeBuild, AWS CodeDeploy

Introduction to Jenkins

**Self Study:** ClouWatch Events for Pipelines

**Further Reading:** Jenkins Pipelines

| UNIT 6 | Advanced Topics in AWS Development | 7 HOURS |
|---|---|---|

**App/System/Case study:** AWS CDK, AWS SAM, AWS Cognito, AWS XRay

**Contents:** AWS CDK - Overview, Benefits, Key concepts and terminology - constructs, stacks, apps, Supported programming languages, Launching resources using AWS CDK

AWS SAM - Introduction, key features, benefits, SAM template anatomy, Creating serverless functions, Building and deploying applications

Amazon Cognito - Introduction, User pools and identity pools, Adding social identity providers (like Facebook, Google, etc.) to the app

AWS X-Ray - Introduction, Setup, Instrumenting application code to generate trace data, Understanding trace data and segments, Visualizing trace data using AWS X-Ray console, Using X-Ray SDKs for various programming languages

**Self Study:** AWS Parameter Store

**Further Reading:** AWS Secrets Manager

## TEXT BOOKS


1. Wittig, Michael, Andreas Wittig, and Ben Whaley. (2015). Amazon web services in action. Manning, Dreamtech Press, ISBN:978-9351198758.
2. Murty, James. Programming amazon web services: S3, EC2, SQS, FPS, and SimpleDB. (2008). O'Reilly Media, Inc.", ISBN 978-0596515812.
3. Tankariya, Vipul, and Bhavin Parmar. (2019). AWS Certified Developer-Associate Guide: Your one-stop solution to pass the AWS developer's certification. 2nd Edition, Packt Publishing Ltd, ISBN 978-1789617313.
4. Alteen, Nick, et al. (2019). AWS Certified Developer Official Study Guide: Associate (DVA-C01) Exam. John Wiley Sons,
5. Van Vliet, Jurg, Flavia Paganelli, and Jasper Geurtsen. (2013). Resilience and Reliability on AWS: Engineering at Cloud Scale. O'Reilly Media, Inc.,
6. Sarkar, Aurobindo. (2018). Learning AWS: Design, build, and deploy responsive applications using AWS Cloud components. 2nd Edition, Packt Publishing Ltd. ISBN 978-1787281066.


## REFERENCE BOOKS


1. Kavis, Michael J. (2014). Architecting the cloud: design decisions for cloud computing service models (SaaS, PaaS, and IaaS). John Wiley Sons, ISBN 978-1118617618.
2. Vacca, John R. (2020). Cloud computing security: foundations and challenges. 2nd Edition, CRC Press, ISBN. 978-0367560331.
3. Furht, Borivoje, and Armando Escalante. (2014). Handbook of cloud computing. Vol. 3. New York: springer, . ISBN. 978-1489994561.


## E-RESOURCES

1. https://docs.aws.amazon.com/
2. https://www.workshops.aws/
3. https://www.terraform.io/
4. https://boto3.amazonaws.com/v1/documentation/api/latest/index.html

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Cloud Native Application Development Lab |
| | **COURSE CODE** | 2304328L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE KNOWLEDGE :** Data Structures, Database Management Systems, Cloud Computing Foundations

**COURSE OBJECTIVES :**

2304328L.CEO.1: To understand how to program various AWS services using SDK
2304328L.CEO.2: To decide the selection of various database services provided by AWS
2304328L.CEO.3: To learn the concept of Infrastructure as a Code
2304328L.CEO.4: To develop the server less applications

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304328L.CO.1: To model the program for accessing AWS Services programmatically [L3]
2304328L.CO.2: To build the API using various protocols [L4]
2304328L.CO.3: To choose an appropriate configuration for provisioning infrastructure as a code [L5]
2304328L.CO.4: To develop and deploy a web application using various cloud services [L6]

**COURSE ABSTRACT:**

The cloud has transformed our lives as individuals as well. Many of us use cloud services every day. When we update our status on social media, binge a new streaming series, or check our bank accounts we're most likely using applications that are hosted by cloud services. These apps are accessed through an internet connection rather than installed on our hard drives or devices.

The main objective of this course is to learn application development using Amazon AWS cloud provider. Finally, the students must develop an end to end application considering some user requirements by applying front-end and back-end technologies which will be deployed on AWS platform.

**PRACTICAL:**

| **PRACTICAL NO.01** | **Programming AWS Services in Python** | **6 HOURS** |
|---|---|---|

- Write a program in Python to count the number of running, stopped and terminated instances
- Write a program in Python to start all the stopped instances
- Write a program in Python to stop all the running instances
- Write a program in Python to implement various IAM operations
- Write a program in Python to create VPC components
- Write a program in Python to implement CRUD operations on RDS, DynamoDB tables, Elasti-cache
- Write a program in Python to implement various S3 operations

| PRACTICAL NO.02 | Provisioning Infrastructure Through Code | 6 HOURS |
|---|---|---|

- Create a CloudFormation Template to create all the VPC Components and Launch an EC2 instance in the VPC created
- Implement the concept of changeset using CloudFormation
- Implement the concept of nested stacks using CloudFormation
- Create a Terraform Template to create all the VPC Components and Launch an EC2 instance in the VPC created

| PRACTICAL NO.03 | Serverless Application Development | 4 HOURS |
|---|---|---|

- Create a Lambda function to receive the details from S3 bucket and display those details
- Create a Lambda function to implement CRUD operations for DynamoDB

| PRACTICAL NO.04 | API Development and Management in AWS | 6 HOURS |
|---|---|---|

- Create a REST based API to implement CRUD Operations for DynamoDB
- Create a WebSocket API

| PRACTICAL NO.05 | Building CI/CD Pipelines on AWS | 6 HOURS |
|---|---|---|

- Implement CodeCommit for a sample web application
- Implement CodeBuild for a sample web application
- Implement Code Deploy for a sample web application

| PRACTICAL NO.06 | Advanced Topics in AWS Development | 8 HOURS |
|---|---|---|

- Create AWS SAM Template for creating a Lambda function
- Create AWS SAM Template for creating a Step Function
- Implement Identity Fedatation using AWS Cognito
- Integrate Lambda function with AWS X-Ray

| PRACTICAL NO.07 | Project | 8 HOURS |
|---|---|---|

Select a web application for deployment on AWS Infrastructure. Create an architecture diagram for the deployment. Launch an architecture by developing a template using CloudFormation / Terraform. After the infrastructure is ready deploy the web application using CI/CD Pipeline

## TEXT BOOKS


1. Wittig, Michael, Andreas Wittig, and Ben Whaley. (2015). Amazon web services in action. Manning, Dreamtech Press, ISBN:978-9351198758.
2. Murty, James. Programming amazon web services: S3, EC2, SQS, FPS, and SimpleDB. (2008). O'Reilly Media, Inc.", ISBN 978-0596515812.
3. Tankariya, Vipul, and Bhavin Parmar. (2019). AWS Certified Developer-Associate Guide: Your one-stop solution to pass the AWS developer's certification. 2nd Edition, Packt Publishing Ltd, ISBN 978-1789617313.
4. Alteen, Nick, et al. (2019). AWS Certified Developer Official Study Guide: Associate (DVA-C01) Exam. John Wiley Sons,
5. Van Vliet, Jurg, Flavia Paganelli, and Jasper Geurtsen. (2013). Resilience and Reliability on AWS: Engineering at Cloud Scale. O'Reilly Media, Inc.,
6. Sarkar, Aurobindo. (2018). Learning AWS: Design, build, and deploy responsive applications using AWS Cloud components. 2nd Edition, Packt Publishing Ltd. ISBN 978-1787281066.


## REFERENCE BOOKS


1. Kavis, Michael J. (2014). Architecting the cloud: design decisions for cloud computing service models (SaaS, PaaS, and IaaS). John Wiley Sons, ISBN 978-1118617618.
2. Vacca, John R. (2020). Cloud computing security: foundations and challenges. 2nd Edition, CRC Press, ISBN. 978-0367560331.
3. Furht, Borivoje, and Armando Escalante. (2014). Handbook of cloud computing. Vol. 3. New York: springer, . ISBN. 978-1489994561.


## E-RESOURCES

1. https://docs.aws.amazon.com/
2. https://www.workshops.aws/
3. https://www.terraform.io/
4. https://boto3.amazonaws.com/v1/documentation/api/latest/index.html

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | CYBER SECURITY AND FORENSICS |
| | COURSE CODE | 2304329T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Computer Networks, Operating Systems

**COURSE OBJECTIVES :**

2304329T.CEO.1: To gain a fundamental knowledge of Cyber threats and Cyber vulnerabilities.
2304329T.CEO.2: To understand the security concerns in IoT devices.
2304329T.CEO.3: To implement a secure application and maintain integrity with the help of network security appliances.
2304329T.CEO.4: To ascertain the usefulness of Information and Enterprise security.
2304329T.CEO.5: To know about the forensic analysis and the investigation process.
2304329T.CEO.6: To use the forensics tools in an investigation process.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304329T.CO.1: Outline different software bugs that pose security threats, and it can attack a network. [L2].

2304329T.CO.2: Identify the issues in implementing secure environment while using IoT devices in the organization. [L3].

2304329T.CO.3: Develop a wide network by selecting right systems and ensuring supportive applications that can speed up all the processes. [L3].

2304329T.CO.4: Analyze the fundamental risk management principles and controlling IT operations to implement security guidelines for various types of Industries [L4].

2304329T.CO.5: Examine Forensics systems with respect to maintaining operations in the presence of risks and threats. [L4].

2304329T.CO.6: Evaluate with the help of Digital Forensic tools the security vulnerabilities in the systems [L5].

**COURSE ABSTRACT:**

Cyber Security is an integral part of the network environment. Cyber security is the practice of protecting systems, networks, and programs from digital attacks. These cyber attacks are usually aimed at accessing, changing, or destroying sensitive information; extorting money from users via ransomware; or interrupting normal business processes. Implementing effective cyber security measures is particularly challenging today because there are more devices than people, and attackers are becoming more innovative.

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **Emerging Cyber Threats and Vulnerabilities** | **08 HOURS** |
| **Applications/Case Study:** Network Security<br>**Contents:** Definition of Cybercrime, Classification of Cybercrimes, Cyber Attacks and Their Counter-measures, Behavioral Aspects of Cyber Security, Role of Cyber Security on Intelligent Transportation Systems, Necessity of Cryptography for Cybersecurity Applications, Application of Cyber Security for Cloud-based Applications. | | |
| **UNIT 2** | **IoT Security and Privacy** | **08 HOURS** |
| **Applications/Case Study:** Display devices- OLEDs, Micro LEDs, Radar displays<br>**Contents:** Trends in Mobility, Security challenges posed by mobile devices, Service Orchestration and Routing for IoT, Privacy, Security, Trust, Identity, and Anonymity in IoT, Threats to mobile applications, analyzers for Mobile Applications to discover Security vulnerabilities, Security architecture in IoT, Android Security Architecture.<br>**Self Study:**Wireless system Design, System architecture, | | |
| **UNIT 3** | **Infrastructure and Application Security** | **06 HOURS** |
| **Applications/Case Study:** Design of different Applications<br>**Contents:** Device Security, Topologies and IDS, Authentication and Authorization, Session Management, Control hijacking attacks – buffer overflow, integer overflow, bypassing browser memory protection, Privilege, access control and Operating System Security, Case Study: Security of E-mail System, Database Security basics.<br>**Self Study:** Firewall Implementation | | |
| **UNIT 4** | **Information and Enterprise Security** | **06 HOURS** |
| **Applications/Case Study:** Enterprise Network<br>**Contents:** Definition, Terminologies, Goals of Information Security and Implementation issues, Access control- password, MFA, -, Security issues in Cloud Computing, Introduction to Enterprise Security, Planning and designing the Security Architecture, Security Architecture: Operations, Security Governance and Risk Management.<br>**Self Study:** E-mail System | | |
| **UNIT 5** | **Digital Forensics** | **06 HOURS** |
| **Applications/Case Study:** Forensics Analysis<br>**Contents:** Overview of Digital Forensics, the sub disciplines, Digital Evidence, Forensics analysis of email, Digital Forensics Life Cycle, Chain of Custody concept, Network Forensics, Relevance of OSI Layers, Data Recovery and OS Forensics, Email Crimes and Violations, Case Study: The Investigation process, Setting up a laboratory.<br>**Self Study:** The methods of data acquisition. | | |

| UNIT 6 | Digital Forensics Tools | 06 HOURS |
|---|---|---|

**Applications/Case Study:** How can a tool be used for forensic analysis

**Contents:** Best Practices, what makes a tool forensically sound, performing tool testing, Classes of Forensics tools.

**Self Study:** Implementation of any tool using kali Linux.

## TEXT BOOKS


1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunit Belpure, Wiley India Edition.
2. Information Systems Security: Security Management, Metrics, Frameworks and best Practices by Nina Godbole Wiley India Edition
3. Cyber SECURITY Protecting Critical Infrastructures from Cyber Attack and Cyber Warfare, Thomas Johnson, CRC Press, taylor Franscis Group
4. Digital Forensics for Legal Professionals: Understanding Digital Evidence from the Warrant to the Courtroom, Larry Daniel, Lars Daniel


## REFERENCE BOOKS


1. Security Architecture: Design, Deployment and Operations by Christopher King, Curtis Dalton, T.Ertem Osmanoglu
2. Information Security: Principles and Practices by Mark Merkow, Jim Breithaupt
3. Internet Security: A Jumpstart for Systems Administrators and IT managers by Tim Speed and Juanita Ellis
4. Web Hacking-Attacks and Defence by Stuart McClure, Saumil Shah, Shreeraj Shah
5. Computer Security Principles and Practices: William Stallings and Larry Brown Pearson edition


## E-R ESOURCES

1. https://nptel.ac.in/courses/106106248

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | CYBER SECURITY AND FORENSICS LAB |
| | COURSE CODE | 2304329L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** NIL

**COURSE OBJECTIVES :**

2304329L.CEO.1: To gain a fundamental knowledge of Cyber threats and Cyber vulnerabilities.
2304329L.CEO.2: To understand the security concerns in web based applications.
2304329L.CEO.3: To implement a secure framework to automate web application security assessment.
2304329L.CEO.4: To ascertain the usefulness of Open Source Intelligence tools.
2304329L.CEO.5: To know about the forensic analysis and the investigation process.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304329L.CO.1: Outline various security threats that can attack the network and the necessary preventive measures implemented using the security policies [L2].
2304329L.CO.2: Identify the injection flaws and ensure website security [L3].
2304329L.CO.3: Develop a framework that can identify the bugs and ensure that the web applications security assessment is done automatically [L3].
2304329L.CO.4: Analyze the bruteforcing Web Applications to discover common vulnerabilities [L4].
2304329L.CO.5: Examine Forensics systems with respect to maintaining operations in the presence of risks and threats. [L4].

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **A. Study of the features of NSA in providing network security and to set Firewall with proper conftguration. B. Conftgure Security parameters in any one web browser C. Study of different types of vulnerabilities for hacking a websites / Web Applications.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.02** | **Implement a penetration testing tool that automates the process of detecting and exploiting SQL injection flaws and taking over of database servers.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.03** | **Install Kali Linux and utilize various security tools for defense of the system.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.04** | **Implement a framework to automate web applications security assessments and could help you to secure your web applications by ftnding and exploiting web application vulnerabilities.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.05** | **Implement wfuzz to discover common vulnerabilities in web applications through the method of fuzzing.** | **2 HOURS** |
| | | |
| **PRACTICAL NO.06** | **Using an OSINT Tool like Shodan or Censys, ftnd out the details about the servers, networks; and internet connected devices.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.07** | **PWN till Dawn lab offensive security** | **2 HOURS** |
| | | |
| **PRACTICAL NO.08** | **Conftgure Wireless Access Point and provide MAC based security. A. Analyze wift traffic. B. Cracking into WEP, WPA2 C. Evil twin attack with fake access point** | **4 HOURS** |
| | | |
| **PRACTICAL NO.09** | **Download and install sleuth kit to identify and recover evidence from available data sets** | **2 HOURS** |

## TEXT BOOKS


1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunit Belpure, Wiley India Edition.
2. Information Systems Security: Security Management, Metrics, Frameworks and best Practices by Nina Godbole Wiley India Edition
3. Cyber Security Protecting Critical Infrastructures from Cyber Attack and Cyber Warfare, Thomas Johnson, CRC Press, taylor Franscis Group
4. Digital Forensics for Legal Professionals: Understanding Digital Evidence from the Warrant to the Courtroom, Larry Daniel, Lars Daniel


## REFERENCE BOOKS


1. Security Architecture: Design, Deployment and Operations by Christopher King, Curtis Dalton, T.Ertem Osmanoglu
2. Information Security: Principles and Practices by Mark Merkow, Jim Breithaupt
3. Internet Security: A Jumpstart for Systems Administrators and IT managers by Tim Speed and Juanita Ellis
4. Web Hacking-Attacks and Defence by Stuart McClure, Saumil Shah, Shreeraj Shah
5. Computer Security Principles and Practices: William Stallings and Larry Brown Pearson edition

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Linux Administration -II |
| | COURSE CODE | 2304366L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Fundamental of Linux operating system, Operating system

**COURSE OBJECTIVES :**

2304366L.CEO.1: To configuring, installing, and upgrading Linux systems using established standards and procedures.
2304366L.CEO.2: To understand security policies using SELinux .
2304366L.CEO.3: To understand filesystems ,partitioning,Logical volume
2304366L.CEO.4: Gain sufficient skill to perform advance system administration tasks on Red Hat Enterprise Linux

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304366L.CO.1: Utilize advance Linux administration tasks [L3].
2304366L.CO.2: Experiment with installation,virtual machine and containers [L3].
2304366L.CO.3: Examine physical storage, file systems ,Logical volume,Network file system [L3].
2304366L.CO.4: Inspect the Linux processes,control services,daemons and advance security administration.[L4].
2304366L.CO.5: Analyze Redhat Linux System with a comprehensive and systematic approach [L4].

**COURSE ABSTRACT:**

This course is specifically designed for students who have completed System Administration I . Linux System Administration II (RH134) focuses on the key tasks needed to become a full time Linux Administrator and to validate those skills . This course goes deeper into Enterprise Linux administration including filesystems and partitioning, logical volumes, SELinux, firewalling, and troubleshooting.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Improving Command-line Productivity:Writing Simple Bash Scripts,Running Commands More Efficiently Using Loops,Matching Text in Command Output with Regular Expressions** | **4 HOURS** |
| **PRACTICAL NO.02** | **Scheduling Future Tasks,Scheduling a Deferred User Job,Scheduling Recurring User Jobs,Scheduling Recurring System Jobs,Managing Temporary Files** | **4 HOURS** |
| **PRACTICAL NO.03** | **Tuning System Performance: Adjusting Tuning Proftles,Influencing Process Scheduling** | **4 HOURS** |
| **PRACTICAL NO.04** | **Controlling Access to Files with ACLs,Interpreting File ACLs,Securing Files with ACLs** | **4 HOURS** |
| **PRACTICAL NO.05** | **Managing SELinux Security: Changing the SELinux Enforcement Mode,Controlling SELinux File Contexts,Adjusting SELinux Policy with Booleans, Investigating and Resolving SELinux Issues** | **6 HOURS** |
| **PRACTICAL NO.06** | **Managing Basic Storage:Adding Partitions, File Systems, and Persistent Mounts,Managing Swap Space** | **6 HOURS** |
| **PRACTICAL NO.07** | **Managing Logical Volumes,Creating Logical Volumes,Extending Logical Volumes** | **4 HOURS** |
| **PRACTICAL NO.08** | **Implementing Advanced Storage Features:Mounting Network-Attached Storage with NFS,Automounting Network-Attached Storage** | **4 HOURS** |
| **PRACTICAL NO.09** | **Accessing Network-Attached Storage: Mounting Network-Attached Storage with NFS,Automounting Network-Attached Storage** | **4 HOURS** |
| **PRACTICAL NO.10** | **Controlling the Boot Process:Selecting the Boot Target,Resetting the Root Password,Repairing File System Issues at Boot,Repairing File System Issues at Boot** | **6 HOURS** |
| **PRACTICAL NO.11** | **Managing Network Security:Managing Server Firewalls,Controlling SELinux Port Labeling** | **6 HOURS** |

| | | |
|---|---|---|
| **PRACTICAL NO.12** | **IRunning Containers,Introducing Containers,Running a Basic Container, Finding and Managing Container Images,Performing Advanced Container Management, Attaching Persistent Storage to a Container,Managing Containers as Services.** | **6 HOURS** |
| **PRACTICAL NO.13** | **Installing Red Hat Enterprise Linux: Installing Red Hat Enterprise Linux, Automating Installation with Kickstart,Installing and Conftguring Virtual Machines** | **2 HOURS** |

**TEXT BOOKS**

1. Red Hat Enterprise Linux 9.0, ”RH134: RED HAT SYSTEM ADMINISTRATION I”, Student Guide

**REFERENCE BOOKS**

1. Red Hat Enterprise Linux 8.2, ”RH134: RED HAT SYSTEM ADMINISTRATION II”, Student Guide

**E-R ESOURCES**

1. https://rha.ole.redhat.com/rha/app/courses/rh124

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | CLOUD SERVICES |
| | COURSE CODE | 2304367L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE KNOWLEDGE :** Cloud Computing Foundations

**COURSE OBJECTIVES :**

2304367L.CEO.1: Identify global infrastructure components of AWS.
2304367L.CEO.2: Differentiate between Amazon S3, EBS, EFS, S3 Glacier.
2304367L.CEO.3: Explore key concepts to Elastic Load Balancing, Amazon CloudWatch, EC2.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304367L.CO.1: Define different types of cloud computing models and Services and Services Categories [L2].
2304367L.CO.2: Create own VPC and add additional components to produce customized network [L6].
2304367L.CO.3: Demonstrate AWS Elastic Beanstalk, AWS Lambda [L4].
2304367L.CO.4: Perform tasks in Amazon RDS database such as launching, configuring and interacting. [L3].
2304367L.CO.5: Configure different types of security monitoring AWS Architectures [L5].

**COURSE ABSTRACT:**

Amazon Web Services offers a broad set of global cloud-based products including compute, storage, databases, analytics, networking, mobile, developer tools, management tools, IoT, security, and enterprise applications: on-demand, available in seconds, with pay-as-you-go pricing. From data warehousing to deployment tools, directories to content delivery, over 200 AWS services are available. Learning AWS can help students land a job in the cloud domain, increase their salary, and advance their career. Learning is beneficial for both beginners and intermediate AWS developers with a few years of experience. Students can take up an AWS certification to learn about AWS and build in-demand cloud skills.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **AWS Global Infrastructure** | **6 HOURS** |

a) Identify the difference between AWS Regions, Availability Zones and edge locations

b) Identify AWS services Service categories.

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Network and Content Delivery.** | **6 HOURS** |

a) Study three fundamental AWS networking and content delivery services: Amazon Virtual Private Cloud (Amazon VPC), Amazon Route 53, and Amazon CloudFront.

b) Label a virtual private cloud (VPC) network architecture diagram

c) Design a VPC, watch how a VPC is built, and build a VPC.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Databases** | **8 HOURS** |

a) Introduction to four of the most commonly used AWS database services:
Amazon Relational Database Service (Amazon RDS) Amazon DynamoDB Amazon Redshift Amazon Aurora

b) Perform tasks in an Amazon RDS database such as launching, configuring, and interacting.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Cloud Architectures.** | **6 HOURS** |

a) Describe the AWS Well-Architected Framework

b) Identify the design principles of the AWS Well- Architected Framework

c) Explain the importance of reliability and high availability

d) Identify how AWS Trusted Advisor helps customers and Interpret AWS Trusted Advisor recommendations

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **AWS EC2 Load Balancing** | **8 HOURS** |

a) Study of three fundamental AWS services Elastic Load Balancing Amazon Elastic Compute Cloud (Amazon EC2) Auto Scaling Amazon CloudWatch

b) Build dynamic, scalable architectures.

c) Indicate how to distribute traffic across Amazon EC2 instances by sing Elastic Load Balancing

| PRACTICAL NO.06 | AWS Auto Scaling . | 6 HOURS |
|---|---|---|

a) Identify how Amazon Cloud Watch enables you to monitor AWS resources and applications in real time

b) Explain how Amazon EC2 Auto Scaling launches and releases servers in response to workload changes.

c) Perform scaling and load balancing tasks to improve an architecture

| PRACTICAL NO.07 | AWS Cloud Security . | 8 HOURS |
|---|---|---|

a) Introduction to the AWS approach to security, controls in the AWS environment

b) Describe different types of security credentials in IAM.

c) Securing a new AWS account, Explore IAM users and groups. Secure AWS data with different methods.

| PRACTICAL NO.08 | Availability and Monitoring . | 8 HOURS |
|---|---|---|

a) Designing an Environment that's Highly Available

b) Creating high available web application

c) Monitoring AWS Architecture using Cloud Watch Cloud Trail, Guard Duty

## TEXT BOOKS


1. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1st Edition
2. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, the McGraw-Hill.


## REFERENCE BOOKS


1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.
2. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Cloud Computing Black Book ,Wiley Dreamtech,ISBN:9789351194187
3. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN: 9789380853772.


## E-R ESOURCES

1. aws.amazon.com/training
2. AWS Academy Educator
3. https://eduskillsfoundation.org/index.php/aws-academy/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Practitioner's Approach to AI |
| | **COURSE CODE** | 2304368L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : 01/07/** | **REVISION NO.** | 0.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Applied Mathematics, Foundation of Computing

**COURSE OBJECTIVES :**

2304368L.CEO.1: To Organize raw data of dataset to improve model performance.
2304368L.CEO.2: To Develop critical thinking skills by solving real-world problems.
2304368L.CEO.3: To Fine-tune hyper-parameters to optimize learning models.
2304368L.CEO.4: To Select learning techniques to solve computer vision and Natural Language Processing Problems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304368L.CO.1: Implement data preprocessing techniques to improve model performance. [L3]
2304368L.CO.2: Apply different learning Models for evaluation of the strengths and limitations for defined real world problem [L3]
2304368L.CO.3: Analyze the optimal configuration of hyperparameters for enhancing the learning models. [L3]
2304368L.CO.4: Compare the learning algorithms, assessing performance, strengths, and weaknesses comprehensively. [L4]

**COURSE ABSTRACT:**

Practitioner's approach to AI delves into the cutting-edge domain of Artificial Intelligence. In today's rapidly evolving technological landscape, the practical application of Artificial Intelligence (AI) is becoming increasingly prevalent across industries. This comprehensive course is designed to equip practitioners with the knowledge, skills, and tools necessary to leverage AI technologies effectively in real-world scenarios.The course begins by providing a solid theoretical foundation in AI, covering key concepts such as machine learning algorithms, neural networks, and deep learning architectures. However, the primary focus lies on bridging the gap between theory and application, empowering participants to tackle practical AI challenges with confidence.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Implementation of Knowledge based Systems.** | **4 HOURS** |
| a) Develop Vacuum Cleaner Agent Application. b) Develop an knowledge base system consisting of facts and rules about some specialized knowledge domain of your choice. | | |
| **PRACTICAL NO.02** | **Implement searching Algorithms using AI.** | **4 HOURS** |
| Find the shortest path for any particular source and destination using A* Algorithm. | | |
| **PRACTICAL NO.03** | **Analyse the performance of Regression Models for a given Application.** | **6 HOURS** |
| Data Preparation and Model Implementation<br>. Select suitable dataset with continuous target variables.<br>. Preprocess data, handle missing values, and encode categorical features. Model Design and Implementation.<br>. Linear regression, Logistic Regression, Multi Variate Regression Model Training and Evaluation.<br>. Split dataset into training and testing sets.<br>. Train each model on training set.<br>. Evaluate models using appropriate metrics(MSE,RMSE,R2)<br>. Comparative Analysis<br>. Compare performance of various regression techniques.<br>.Analyze strengths, weaknesses, interpretability, computational efficiency, and model complexity. Conclusion<br>. Summarize findings, provide recommendations, and discuss improvement areas<br>. | | |

| PRACTICAL NO.04 | Implement and compare different classiftcation algorithms. | 6 HOURS |
|---|---|---|
| Data Preprocessing: Prepare the dataset by handling missing values, encoding categorical variables, and scaling features.<br>Model Implementation: Develop classification models using Naive Bayes, KNN,SVM and Decision Trees (CART)<br>Training and Evaluation: Train each model on a portion of the dataset and evaluate their performance using relevant metrics (accuracy, precision, recall, F1-score,loss).<br>Comparative Analysis: Compare the results obtained from each algorithm to identify patterns and differences.<br>Conclusion: Summarize the findings and discuss the suitability of each algorithm for various classification tasks. | | |

| PRACTICAL NO.05 | Implement and Analyse the effect of Ensemble Learning in Classiftcation | 4 HOURS |
|---|---|---|
| Dataset Selection and Preprocessing:Preprocess images from selected dataset for resizing, normalization, and data augmentation.<br>Stacking: Implement a stacking ensemble using a meta-classifier to combine predictions from base classifiers.<br>AdaBoost: Implement an AdaBoost ensemble using chosen base classifiers. Voting: Implement a voting ensemble that combines the predictions of the base classifiers through majority voting.<br>Model Comparison: Compare the performance of the ensemble models using appropriate classification metrics.<br>Analysis and Interpretation: Analyze the strengths and weaknesses of each ensemble method, explore scenarios where one method may outperform the others, and discuss the impact of diversity among base classifiers on ensemble performance.<br>Conclusion: Summarize the findings, provide insights into when to use each ensemble method, and suggest potential areas for further research or improvement. | | |

| PRACTICAL NO.06 | Design , Implement, and Evaluate Neural Networks for Classiftcation. | 4 HOURS |
|---|---|---|
| ata set preprocessing<br>Neural Network Architecture Design:Create image classification neural network; choose activations, loss, and optimizers.<br>Model Implementation:Implement the neural network framework for data loading, model training, and evaluation.<br>Training the Neural Network:Separate data into training and testing, track loss and accuracy.<br>Model Evaluation: Assess model on test set, compute metrics, and visualize confusion.<br>Hyperparameter Tuning:Explore the impact of hyperparameters on model performance.<br>Conclusion and Reflection: Summarize results and discuss model performance. | | |

| PRACTICAL NO.07 | Implement suitable application using Pre-trained Convolutional Neural Network for Image Classiftca-tion | 6 HOURS |
|---|---|---|
| Choose a relevant dataset for image classification.<br>Select a pre-trained CNN model that suits the dataset's nature.<br>Prepare the dataset for training, perform data augmentation, normalization, and preprocessing.<br>Load the pre-trained CNN model and modify the final layers for the specific classification task.<br>Train the modified CNN on the dataset using transfer learning techniques.<br>Evaluate the performance of the fine-tuned model on a separate validation set.<br>Visualize the model's predictions on sample images from the validation set.<br>Compare the fine-tuned model with a baseline model.<br>Experiment with hyperparameter tuning and optimization strategies to improve the model's perfor-mance. | | |

| PRACTICAL NO.08 | Design the model for Object Detection, Segmenta-tion, and Recognition Using Deep Learning. | 4 HOURS |
|---|---|---|
| Select a dataset with annotations for object detection, segmentation masks, and class labels.<br>Preprocess the dataset for training, including image resizing, normalizing pixel values, and handling annotations.<br>Design a deep learning model architecture for object detection, segmentation, and recognition.<br>Train the model and implement multi-task learning.<br>Experiment with hyper-parameter values and optimize parameters.<br>Evaluate the model on a separate test dataset.<br>Fine-tune the model using transfer learning.<br>Implement optimization techniques for object detection and segmentation.<br>Create visualizations of model predictions.<br>Discuss challenges and potential real-world applications. | | |

| PRACTICAL NO.09 | Implement and Analyse the performance of different Machine Learning Algorithms for Sentiment Analysis on Review. | 4 HOURS |
|---|---|---|

Data Acquisition and Preprocessing: Obtain dataset with sentiment labels.Perform data cleaning, remove stopwords, punctuation, irrelevant information. Visualize sentiment distribution in dataset.
Text Representation: Convert the preprocessed text data into numerical vectors using techniques such as TF-IDF (Term Frequency-Inverse Document Frequency) or word embeddings like Word2Vec , GloVe.
Model Development: Implement a baseline sentiment analysis model using a machine learning algorithm (e.g., Logistic Regression or Naive Bayes).
Model Training and Evaluation:Divide the dataset into training and testing sets, train both baseline and advanced models on the training set, and evaluate the models on the testing set using metrics.
Conclusion:Summarize Key findings and insights are summarized, along with recommendations for improving model performance and addressing challenges, and suggestions for future research in NLP and sentiment analysis.

| PRACTICAL NO.10 | Implement and Analyse deep sequence models for sequence classiftcation. | 4 HOURS |
|---|---|---|

Select relevant NLP datasets like sentiment analysis, text classification, named entity recognition, or machine translation.
Perform data preprocessing tasks like tokenization, padding, and embedding.
Design sequence model's architecture specifying layers, recurrent layers, and activation functions.
Train the sequence model on the selected NLP dataset.
Experiment with hyperparameter values for improved performance.
Choose appropriate evaluation metrics for the selected NLP task.
Evaluate the trained sequence model on a separate test dataset.
Discuss challenges and considerations during training and evaluation.
Summarize results, discuss strengths and limitations, and provide insights into improvements.

| PRACTICAL NO.11 | Implement deep sequece models for sequence generation. | 4 HOURS |
|---|---|---|

Select a deep learning framework and Seq2seq model suitable for NLP tasks.
Select a relevant dataset relevant to a Seq2seq NLP task.
Perform data preprocessing tasks such as tokenization, padding, and embedding.
Design encoder and decoder architecture, attention mechanism, and activation functions.
Train and Experiment with hyperparameter values for improved performance.
Select appropriate evaluation metrics for the selected seq2seq NLP task and compare the model's performance with baseline models or traditional NLP approaches.
Implement optimization techniques to improve the stability and convergence of the seq2seq model.
Summarize the results, discuss strengths and limitations, and provide insights into potential improvements.

| PRACTICAL NO.12 | Implement Image Synthesis using GAN. | 4 HOURS |
|---|---|---|
| Setup of TensorFlow and Keras, providing a starter code template.<br>Dataset Loading, Generator Model, Discriminator Model, and GAN Model.<br>Compilation of generator, discriminator, and GAN models with appropriate loss functions and optimizers.<br>Training Loop, Evaluation and Visualization, Experimentation, Results and Discussion. | | |
| **MINI PROJECTS** | | **10 HOURS** |
| Implement a mini project making use of the concepts of Machine Learning algorithms, Deep Neural Networks for any of the application domain like computer vision, Matural Language processing. | | |

## TEXT BOOKS


1. Stuart Russell and Peter Norvig. (2016). Artificial Intelligence: A Modern Approach", Pearson, ISBN: 978-0134610993.
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville. (2016).Deep Learning". The MIT Press,ISBN: 978-0262035613.
3. Christopher M. Bishop. (2006). Pattern Recognition and Machine Learning", Springer, ISBN: 978-0387310732.


## REFERENCE BOOKS


1. Kevin P. (2012). Murphy,"Machine Learning: A Probabilistic Perspective", ISBN: 978-0262018029,Publisher: MIT Press.
2. Andreas Muller. (2016). "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly; ISBN: 978-9352134571
3. Prateek Joshi. (2016)."Python Machine Learning. Packt Publishing Limited. ISBN-13:978-8120337312
4. Rajalingappaa Shanmugamani.(2018). "Deep Learning for Computer Vision", Packt Publishing, ISBN: 978-1788295628.
5. Aurelien Geron. (2019). "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", O'Reilly Media, ISBN: 978-1492032649.
6. Maxim Lapan. (2018). "Deep Reinforcement Learning Hands-On", Packt Publishing, ISBN: 978-1788834247.
7. Seth Weidman, (2019). "Deep Learning from Scratch" Publisher: O'Reilly Media, ISBN: 978-1492045113.


## E-R ESOURCES

1. https://developer.nvidia.com/deep-learning
2. https://builtin.com/machine-learning/deep-learning
3. https://www.deeplearningbook.org/

## TEXT BOOKS


1. Prashanth K R, Darshan P R, Archana K (2023). *DOTNET Programming Using C#*. 1st Edition, Bluerose Publishers Pvt. Ltd. ISBN 9789358194333.
2. Grover Damini (2011) . *Dot Net Technology* . 2011 Edition, I K International Publishing House Pvt. Ltd ISBN:9789381141342.


## REFERENCE BOOKS


1. Herbert Schildt (2010). *C# 4.0 The Complete Reference*. 13th Edition, McGraw-Hill, ISBN: 978-0071741163.
2. Kris HermansKris Hermans (2023). *C# 4.0 Mastering .Dot Net Framework: A Comprehensive Guide To Master The .Dot Net Framework*. 1st Edition, Cybellium Ltd.
3. Thuan L. Thai, Hoang Lam (2022). *.NET Framework Essentials Introducing the .NET Framework*. 3rd Edition, O'Reilly Media.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Web and Desktop Application Development |
| | COURSE CODE | 2304369L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE KNOWLEDGE :** Web Technology

**COURSE OBJECTIVES :**

2304369L.CEO.1: To make understand DotNet Framework, Components, Visual Studio Software Installation and the different languages supported in DotNet.
2304369L.CEO.2: To implement C# program structure.
2304369L.CEO.3: To explore the Windows Forms, Namespace, execution of Windows Form, available tools and their events.
2304369L.CEO.4: To provide fundamentals of ADO.NET Architecture with its API, available classes and objects in API.
2304369L.CEO.5: To apply the need of Collections and Assemblies in the DotNet Programming.
2304369L.CEO.6: To implement ASP.NET MVC Architecture for web applications designing.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304369L.CO.1: Implement object-oriented programming in C# [L3].
2304369L.CO.2: Demonstrate application development with C# basic constructs[L3].
2304369L.CO.3: Design windows forms for different applications using C# [L6].
2304369L.CO.4: Use Entity Framework to work with relational databases for connecting with C# and ASP.NET applications[L3].
2304369L.CO.5: Develop web applications using a combination of client-side and server-side technologies to build multi-tier application[L6].

**COURSE ABSTRACT:**

The Web and Desktop Application Development course offers a comprehensive exploration of fundamental concepts and practical applications of DotNet Programming. Beginning with C# basics and Object-Oriented Programming (OOPs), students delve into advanced topics such as Windows Form designing, ADO.NET for database connectivity, and mastering Collections and Assemblies. The curriculum culminates in a thorough understanding of ASP.NET for web development. Throughout the course, students engage in hands-on learning experiences, including a mini-project where they apply their skills to solve real-world problems by designing softwares and web applications. By the end, students emerge proficient in .NET development, equipped with the knowledge and skills to tackle diverse software engineering challenges.

**PRACTICALS**

| **PRACTICAL NO.01** | **Getting Started with DotNet and Introduction to C#** | **6 HOURS** |
|---|---|---|

Contents to be taught: Introduction to DotNet Framework, DotNet Versions, Visual Studio Versions, Installation, Features of Visual Studio IDE, Creating Project, Solution Using Visual Studio IDE, C# language basics (Syntax, data types, operators).
Practical Statement:

(a) Install Visual Studio and create a simple ”Hello World” console application.

(b) Write a program to demonstrate C# keywords like class, namespace, static, etc.

(c) Write a program to demonstrate C# data types like int, double, string, etc.

(d) Write a program to demonstrate C# operators like arithmetic, relational, logical etc.

(e) Write a program that takes user input and makes a decision based on if-else and switch conditional statements

| **PRACTICAL NO.02** | **OOPs using C# and Exception Handling** | **8 HOURS** |
|---|---|---|

Contents to be taught: Object-Oriented Programming concepts in C# (Classes, Objects, Methods, Inheritance, Polymorphism), Exception Handling. Practical Statement:

(a) Write a program to print numbers from 1 to 100 using a for loop and while loop

(b) Write a program to reverse a string using for/while loop

(c) Write a program to simulate a simple calculator using switch case

(d) Write a program to demonstrate class, objects, access modifiers

(e) Write a program to show inheritance using base and derived classes and also implement encapsulation using getters and setters

| PRACTICAL NO.03 | Collections and Assemblies | 6 HOURS |
|---|---|---|

Contents to be taught: Collections (Lists, Dictionaries), Assemblies (Types, Creation, Usage).
Practical Statement:

(a) Implement a C# console application that utilizes a collection (e.g., List, Dictionary) to store and manage a list of student records, including their names and grades.

(b) Create a C# class library project containing reusable components for mathematical operations (e.g., addition, subtraction, multiplication). Compile the library into an assembly and demonstrate its usage in multiple C# applications.

(c) Develop a C# program that reads a text file containing a list of words and stores them in a collection. Implement functionality to count the occurrences of each word and display the results in descending order of frequency.

(d) Build a C# application that utilizes a custom assembly containing encryption and decryption methods. Implement functionality to encrypt sensitive data input by the user and decrypt it for display.

| PRACTICAL NO.04 | Windows Forms using C# | 8 HOURS |
|---|---|---|

Contents to be taught: Creating Windows Forms Applications, Working with Controls (Labels, Textboxes, Buttons, etc.), Handling Events, Windows form deployment.
Practical Statement:

(a) Design Student Registrations Windows Form

(b) Design Unit Converter App with for various parameter (temp, length, etc)

(c) Design Simple Calculator App consider all basics operations.

| PRACTICAL NO.05 | ASP.NET MVC Architecture and Introduction | 10 HOURS |
|---|---|---|

Contents to be taught: Introduction to ASP.NET, First MVC Application, Understanding project structure, URL Routing, Introducing URL Patterns ,Creating and Registering a Simple Route, Razor Basic, Implementation of Razor, Razor Markup, View Data, Creating Forms, submit forms using view data, Adding different ASP.net components on pages.
Practical Statement:

(a) Develop a web page for managing products in an online store.

(b) Design a web application for tracking student grades.

(c) Develop an employee directory web application for a company.

| PRACTICAL NO.06 | ADO.NET | 8 HOURS |
|---|---|---|

Contents to be taught: ADO.NET Architecture, Database Connectivity with windows form and ASP.NET application, Basic CRUD operations, Navigation of data in data objects using Disconnection oriented model with SqlDataAdapter DataSet, DataTable, etc.
Practical Statement:

(a) Implement a C# console application that connects to a SQL Server database using ADO.NET. Allow the user to perform basic CRUD operations (Create, Read, Update, Delete) on a table of their choice.

(b) Create an ASP.NET web application that utilizes ADO.NET to connect to a SQL Server database. Develop a page where users can input data into a form and submit it to be stored in the database. Include validation for user input.

| PRACTICAL NO.07 | ASP.NET Development and Deployment Teaching | 10 HOURS |
|---|---|---|

Contents to be taught: Creating Forms, submit forms using view data, Adding different ASP.net components on pages, Authentication using Microsoft Identity, Creating a ASP.net web application with database and all CRUD operations, Areas in MVC 5 ,Filters in MVC5 ,Authorization Filter , Action Filter,Result Filter ,Exception Filter, Deployment of web application on the cloud.
Practical Statement:

(a) Create an ASP.NET web application featuring a user registration form. Utilize ADO.NET to connect to a SQL Server database and implement functionality to insert user information (e.g., username, email, password) into the database upon form submission. Include validation for required fields and email format.

(b) Develop a web page for managing products in an online store. Implement CRUD operations (Create, Read, Update, Delete) using ADO.NET to interact with a SQL Server database. Allow users to add new products, view existing products, update product details, and delete products from the database.

(c) Design a web application for tracking student grades. Create a page where teachers can input student grades for different subjects. Use ADO.NET to store and retrieve grade information from a SQL Server database. Implement features to calculate and display average grades for each student.

| MINI PROJECTS | | 4 HOURS |
|---|---|---|

Design College Placement Tracking System / Time table making system/ Canteen food ordering/Apartment Management System/Matrimony Site/ Gym and Fitness Club Website using C# and Asp.net.

## TEXT BOOKS


1. Prashanth K R, Darshan P R, Archana K (2023). *DOTNET Programming Using C#*. 1st Edition, Bluerose Publishers Pvt. Ltd. ISBN 9789358194333.
2. Grover Damini (2011) . *Dot Net Technology* . 2011 Edition, I K International Publishing House Pvt. Ltd ISBN:9789381141342.


## REFERENCE BOOKS


1. Herbert Schildt (2010). *C# 4.0 The Complete Reference*. 13th Edition, McGraw-Hill, ISBN: 978-0071741163.
2. Kris HermansKris Hermans (2023). *C# 4.0 Mastering .Dot Net Framework: A Comprehensive Guide To Master The .Dot Net Framework*. 1st Edition, Cybellium Ltd.
3. Thuan L. Thai, Hoang Lam (2022). *.NET Framework Essentials Introducing the .NET Framework*. 3rd Edition, O'Reilly Media.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Natural Language Processing Lab |
| | COURSE CODE | 2304370L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Requires knowledge of Probability and Statistics, Machine Learning

**COURSE OBJECTIVES :**

2304370.CEO. 1: To understand fundamental concepts of natural language structure, processing, and representation for computational models.

2304370.CEO. 2: To develop and implement NLP techniques such as tokenization, tagging, parsing, and information extraction using open-source tool.

2304370.CEO. 3: To apply statistical approaches to real-world NLP applications like sentiment analysis, chatbots, and question-answering systems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

23043270.CO. 1: Apply basic text preprocessing and linguistic analysis techniques on textual data using Python NLP libraries. [L3].

23043270.CO. 2: Perform syntactic and semantic analysis using POS tagging, chunking, parsing, and entity recognition methods. [L4].

23043270.CO. 3: Implement statistical and vector-based models for language understanding. [L4].

23043270.CO. 4: Evaluate deep learning models (LSTM, BERT) for NLP applications. [L5].

23043270.CO. 5: Design and demonstrate real-world NLP systems like chatbots, text classifiers, or summarizers. [L6].

**COURSE ABSTRACT:**

This course on NLP provides a comprehensive overview of aspects of Natural Language Processing (NLP) enabling machines to interpret, process, and generate human language. Students will learn essential text preprocessing, syntactic and semantic analysis, and implementation of classical and neural NLP models. Emphasis is placed on hands-on experimentation with real datasets, using Python and modern NLP frameworks such as NLTK, spaCy, Gensim, TensorFlow, and HuggingFace Transformers. By the end of the course, students will be able to design and evaluate NLP applications like chatbots, text classifiers, and summarizers.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Text Preprocessing and Linguistic Basics** | **6 HOURS** |

Tokenization: Breaking text into words, sentences, or subwords. Morphology: Study of word structure and formation — root, prefix, suffix.

Perform basic text cleaning, tokenization, and morphological analysis using Python NLP libraries.

a. Read a text corpus and perform sentence and word tokenization.
b. Remove stop words and punctuations.
c. Apply stemming and lemmatization using NLTK/spaCy.
d. Analyze frequency of morphemes and roots.

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Part-of-Speech Tagging and Chunking** | **6 HOURS** |

POS Tagging: Assigning word classes (noun, verb, adjective, etc.) using probabilistic models. Constituency Grammar: Parsing sentences into hierarchical phrase structures (NP, VP).

Identify parts of speech and extract syntactic phrases using parsing.

a. Apply POS tagging using spaCy.
b. Extract noun and verb phrases using chunk grammar.
c. Visualize dependency relations.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Named Entity Recognition (NER)** | **6 HOURS** |

Named Entity Recognition: Identifying named entities such as persons, organizations, and locations.

Information Extraction: Extracting structured data from unstructured text.

Identify entities and categorize them from text using pre-trained NLP models.

a. Perform NER on a news article.
b. Visualize named entities by label.
c. Count frequency of each entity type.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Language Models – N-Gram Approach** | **6 HOURS** |

N-Gram Language Models: Predicting words based on previous N–1 words. Perplexity: Measure of how well a probability model predicts text.

Build unigram, bigram, and trigram models for text generation.

a. Tokenize a corpus and generate n-grams.
b. Compute conditional probabilities for bigrams.
c. Generate sentences using probabilistic selection.
d. Evaluate model perplexity.

| PRACTICAL NO.05 | Vector Semantics and Word Embeddings | 6 HOURS |
|---|---|---|

Distributional Semantics: Meaning inferred from word context ("you shall know a word by the company it keeps"). Word2Vec: Neural embedding model using CBOW or Skip-gram
Represent words as dense vectors and measure semantic similarity.

a. Train Word2Vec model using Gensim.
b. Find most similar words.
c. Visualize word vectors using t-SNE.

| PRACTICAL NO.06 | Text Classiftcation and Sentiment Analysis | 6 HOURS |
|---|---|---|

Bag of Words Model: Representing text as word frequency vectors. Na¨ıve Bayes Classifier: Probabilistic model assuming feature independence.
Classify text (positive/negative) using TF-IDF and Na¨ıve Bayes.

a. Preprocess dataset (movie reviews).
b. Represent text using TF-IDF.
c. Train and test Na¨ıveBayes model.
d. Evaluate using accuracy and confusion matrix.

| PRACTICAL NO.07 | Sequence Modeling | 8 HOURS |
|---|---|---|

RNN Architecture: Neural network that captures sequential dependencies. LSTM (Long Short-Term Memory): Addresses vanishing gradient problem in long sequences.
Build and train a simple LSTM for text generation.

a. Prepare dataset and encode text.
b. Build an LSTM model using Keras.
c. Train and generate text sequence.

| PRACTICAL NO.08 | NLP Application – Chatbot / QA System | 8 HOURS |
|---|---|---|

**Dialogue Systems:** Conversational agents using intent detection and slot filling. **Transformer Architecture:** Attention-based neural model (e.g., BERT, GPT).
Build a simple chatbot or QA system using a transformer-based model.

a. Implement intent detection using pretrained BERT model.
b. Create chatbot interface (CLI or web).
c. Handle at least 5 intents (greetings, info, farewells, etc.).

| PRACTICAL NO.09 | Text Summarization using HuggingFace Model | 8 HOURS |
|---|---|---|

Implement and compare text summarization techniques using HuggingFace transformer models

a. Choose a long news/Wikipedia article and clean the text (remove extra spaces, special characters).
b. Use any HuggingFace model (e.g., facebook/bart-large-cnn or t5-small) to generate a short summary.
c. Use one more HuggingFace summarization model and compare both summaries based on length, clarity, and meaning.
d. Evaluate Summaries using ROUGE Score and Fine tune the model.

## TEXT BOOKS


1. Daniel Jurafsky and James H. Martin. (2023). *"Speech and Language Processing"* . 3rd Edition, Pearson Education.
2. Steven Bird, Ewan Klein, and Edward Loper .(2009).*Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit* . O'Reilly Media .


## REFERENCE BOOKS


1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze (2008). *Introduction to Information Retrieval* . Cambridge University Press .
2. Delip Rao and Brian McMahan. (2019). *Natural Language Processing with PyTorch: Build Intelligent Language Applications* . O'Reilly,


## E-RESOURCES

1. https://www.deeplearning.ai/resources/natural-language-processing/
2. https://www.geeksforgeeks.org/natural-language-processing-nlp-tutorial/
3. https://realpython.com/natural-language-processing-spacy-python/
4. https://www.freecodecamp.org/news/natural-language-processing-techniques-for-beginners/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Employability and Career Development |
| | **COURSE CODE** | 2301371L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PRE-REQUISITE KNOWLEDGE :** Communication Skills, Universal Human Values-II.

**COURSE OBJECTIVES :**

2301371L.CEO.1: To define the importance of Employability skills in students life.
2301371L.CEO.2: To explain them necessary, specific Employability Career Development skills.
2301371L.CEO.3: To appraise students for placements through acquisition of professional skills.
2301371L.CEO.4: To support them detect their present level in respect of each Career Development skill and show direction for improvement..

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301371L.CO.1: Relate the importance of Employability Career Development [L2].
2301371L.CO.2: Build necessary, specific professional skills [L3].
2301371L.CO.3: Analyze the environment of employability [L4].
2301371L.CO.4: Develop various techniques of effective team building in their professional life [L6].

**COURSE ABSTRACT:**

The Employability and Career Development course is designed to enhance students' career readiness and personal growth through practical exercises focused on key aspects of professional development. The course covers self-management skills such as time management and goal setting, essential for personal productivity. Students will engage in personal interviews and group discussions to strengthen their communication abilities and public speaking confidence. Team building and motivational practices are explored to foster collaboration and a positive work environment. Innovative thinking is emphasized to cultivate creativity and adaptability in problem-solving. Additionally, students will learn profile development strategies, including crafting impactful resumes and LinkedIn profiles to enhance their professional online presence. By incorporating aptitude training and a focus on employability, the course aims to equip students with the necessary skills and mindset for success in their careers.

| **SECTION A: Personal Development with the help of Professionals (25 Marks)** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Self Management** | **4 HOURS** |
| Concept of Johari Window,Advantages and disadvantages of every quadrant,Identifying the proportion of each quadrant in respect of self, Using the tools of self-evaluation, self-development and Goal Setting, Stress management, Career anchor. | | |
| **PRACTICAL NO.02** | **Personal Interviews** | **4 HOURS** |
| Preparing for Interviews, Typical expected questions suggested responses, Posture, Body language, Greetings and pleasantries, , Handling unforeseen questions. | | |
| **PRACTICAL NO.03** | **Group Discussion and Public Speaking** | **4 HOURS** |
| Parameters of assessment,Initiating the discussion,Effective listening,Own contribution,Paraphrasing,Arguing and counter-arguing, Giving direction to the discussion, Public Speaking skills. | | |
| **PRACTICAL NO.04** | **Team Building and Motivation** | **4 HOURS** |
| Hallmark of effective teams, Barriers to teamwork, Subjugation of Individual interests for achievement of teams goal, Leading motivating team members. | | |
| **PRACTICAL NO.05** | **Innovative Thinking** | **4 HOURS** |
| Relevance and importance of innovative thinking, Introduction to Brain Storming technique,Collective and individual Brain Storming. | | |
| **PRACTICAL NO.06** | **Proftle Development** | **6 HOURS** |
| Resume Writing: Introduction to the Resume, Key Components of a Resume and Cover Letter, Enhancing tips for Resume and Cover Letter.<br>Letter of recommendation (LOR) preparation: Details on types, samples, structure, content tips format for letters of recommendation for student.<br>Statement of Purpose (SOP) preparation: SOP Formats, Templates, and Guidelines for SOP Writing.<br>Job application and professional email writing. | | |

| SECTION B: | Aptitude Training from Video Based Content and Assessment Platform. (25 Marks) | 30 HOURS |
|---|---|---|

1. Number System
2. HCF LCM , Surds and Indices.
3. Percentages and Average.
4. Time and work.
5. Time, Speed and Distance.
6. Probability.
7. Quadratic Equations.
8. Profit and Loss.
9. Simple and Compound Interest.
10. Ratio and proportion.
11. Permutation and Combination.
12. Boats and Streams, Pipes and Cisterns.
13. Mixtures and Allegations, Mensuration.
14. Data Interpretation – Tables, Pie Charts, Bar Graphs, Line Graphs.

| SECTION C: | Final Assessment with the help of career Assessment Test (25 marks) | 2 HOURS |
|---|---|---|

**TEXT BOOK**


1. J.K.Gangal, A Practical Course in Effective English Speaking Skills, Prentice Hall India Learning Private Limited (2012), ISBN-10: 8120345843.
2. Jean Yates, Practice Makes Perfect: English Conversation, Premium Second Edition, McGraw-Hill Education; 2 edition, ISBN-10: 1259643271.
3. R S Agrawal, Quantitative Aptitude, S. Chand Publishing (2020), ISBN: 9789352534029, 9789352534029.
4. Shakuntala Devi, Puzzles to Puzzle You, Orient Paperbacks, ISBN: 9788122200140, 9788122200140.


**REFERENCE BOOK**


1. Stephen Covey: The Seven Habits of Highly Effective People, Simon and Schuster Ltd, ISBN: 0-671-71117-
2. Krishna Mohan, Meera Banerji, Developing Communication Skills, Birla Institute of Technology and Science, ISBN: 033392-919-5.
3. Charles Kepner and Benjamin Tregoe, The Rational Manager: A systematic Approach to Problem Solving and Decision Making , Tata McGraw-Hill Publishing Company Ltd., ISBN:13:978-0070341753.
4. Priyadarshini Patnaik, Group Discussion and Interview Skills , Foundation Books, 1st Ed.- 2011, ISBN No.: 9788175967847, 8175967846.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Major Project - II |
| | **COURSE CODE** | 2304392L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304392.CEO.1: To equip students with the knowledge and skills necessary to design innovative engineering solutions for complex technical problems.

2304392.CEO.2: To train students in the practical implementation of engineering designs, ensuring they can bring theoretical concepts to life using modern tools and techniques.

2304392.CEO.3: To understand how to create detailed project plans that encompass all stages of implementation, from initial concept to final product.

2304392.CEO.4: To foster students ability to critically evaluate and iterate on their implementations, incorporating feedback and testing results to optimize performance and effectiveness.

2304392.CEO.5: To enhance students communication skills, enabling them to effectively present their implementation processes and outcomes to diverse audiences.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304392.CO.1: Demonstrate proficiency in implementing engineering designs, utilizing modern tools, techniques, and technologies to bring their solutions to fruition [L4].

2304392.CO.2: Conduct rigorous testing and evaluation of implemented solutions, analyzing performance data to ensure that the solutions meet specified requirements and quality standards [L5].

2304392.CO.3: Incorporate ethical considerations and sustainable practices into their implementation processes, evaluating the societal and environmental impacts of their solutions [L3].

2304392.CO.4: Work effectively in multidisciplinary teams, demonstrating strong collaboration, leadership, and project management skills throughout the implementation phases [L3].

## COURSE ABSTRACT:

The project is most important part of undergraduate curriculum and enables students to develop analytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Project Design, Project Implementation and Project Evaluation. After successful completion of project design phase in Sem V (project design), next step is project implementation (Sem VI). The goal of this phase of the project is to implement/develop/experiment/simulate/test the techniques/processes of the project and give a mature shape. The implementation can be a combination of algorithms, techniques, processes, testing etc. This will also include drawing inferences from the results and discussing them.

## GUIDELINES

1. Preferably project group students of Sem V would be continued in this semester VI.
2. Every project group should consist of minimum 03 and maximum of 04 students.
3. The group members may be from different programs to support the interdisciplinary functioning.
4. Project group members and title of the project need to be approved by Project Guide and School.
5. Projects should preferably have a national/international, industry/academic/research collaboration.
6. User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
7. The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.
8. Define proposed solution and apply project management/modeling tools for project planning and design.
9. Define outcome, milestones, definite roadmap for project design, implementation, tools, resources, performance evaluation and documentation.
10. Perform refinement of System architecture & methodology.
11. Students should give a mature shape to their idea in terms of implementation. This is expected in this semester. This may include one or many of these points. Implementation /development/experimentation/simulation/testing/building the techniques/processes

**Collaborative/Sponsored Project**

1. Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for project work.
2. Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization at the start of semester VI.
3. Proposed Collaborative Project work need to be reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of 12 months.
4. Final assessment will be carried out in presence of faculty mentor, external mentor and examiner.

**TIMELINE**

1. Freezing of project groups and titles. Refinement of title and objectives from Sem V should freezed by the time of first review.
2. Final Synopsis of the project. (To be done at guide level)
3. Methodology / System Design / Block Diagram should be properly explained by the student
4. Project Review I Presentation.
5. Project Implementation: Students should take the work in one and/more of the points. Like Implementation/development/experimentation/simulation/testing/experimental yield/building the techniques/processes etc. ..
6. Based on the points discussed in 5, student would be able to get results and discuss them. Students should be able to draw inferences from results.
7. Project Review II Presentation.
8. Quality of Publication and Researchers: Students would be educated on different technical papers and their importance (article types, journal metrics etc) along with author/researcher credentials.
9. Project Documentation: Project Report Writing

## ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Project Review I: Problem Statement and objectives, Implementation plan & action (algorithms/techniques/models/mathematical understanding/implementation) (10 Marks)
2. An activity on illustrating methodology. This may inlcude paper reading activity: Read and Summarize a paper in 1 page (Individual to every student of the group). Any other activity can also be taken take would illustrate methodology (10 marks)
3. Project Review II: Results and Implementation, Observations, Inferences, Discussion on algorithms / techniques /models / testing) (10 Marks)
4. Article Quality and Author Credentials: Information about Research Article types, paper quality metrics (SCI/SCOPUS/WOS) and Author Credentials (Citation count, h-index, I10 index etc) (5 marks)
5. Project Report (10 Marks)
6. Project: Documentation Final Presentation and Demonstration (30 Marks)

(Parameters of evaluation: Final implemented work, report, presentation and paper drafted based on work)

## TEXT BOOKS


1. John M. Nicholas. (2012). *Project Management for Engineering, Business and Technology*. 4th Edition, Butterworth-Heinemann. ISBN 978-0080967042.
2. Leslie Lamport. (1994). LaTeX: *A document preparation system, User's guide and reference manual*. 2nd Edition, Addison-Wesley. ISBN 978-0201529838.


## REFERENCE BOOKS


1. Michelle Reid. (2018). *Report Writing (Pocket Study Skills)*. 2nd Edition, Bloomsbury Publishing. ISBN 978-0230376557.
2. Sara Efrat Efron and Ruth David. (2018). *Writing the Literature Review : A Practical Guide*. 1st Edition, Guilford Press . ISBN 978-1462536894 .


## E-R ESOURCES

1. e-Yantra: Engineering for better Tomorrow
2. Zotero

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# Final Year

# Bachelor of Technology

# Computer Engineering

## NEP REVISION (NEP)

(With Effect from Academic Year: )

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: VII (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | CREDIT |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304411T | System Design | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 2304421T | Big Data Analytics | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2304422T | Generative AI Applications | | | | | | | | | | |
| | 2304423T | Cloud Native DevOps | | | | | | | | | | |
| | 2304424T | Ethical Hacking & Cyber Laws | | | | | | | | | | |
| | 2304421L | Big Data Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2304422L | Generative AI Applications Lab | | | | | | | | | | |
| | 2304423L | Cloud Native DevOps Lab | | | | | | | | | | |
| | 2304424L | Ethical Hacking & Cyber Laws Lab | | | | | | | | | | |
| MDM | *MDM List | Multidisciplinary Minor Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| HSSM MEC | 2304476T | Project Management | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2304491L | Major Project - III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC PRJ | 2304492T | Research Methodology | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC SI | 2304496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| **TOTAL** | | | **13** | **6** | **-** | | | | | | **750** | **20** |

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: VIII (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304412T | Cyber Security | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 230442XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2304SWXX | SWAYAM Course* | - | - | - | 25 | - | 75 | - | - | | |
| MDM | *MDM List | MDM Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 23XXSWXX | SWAYAM Course (MDM)* | - | - | - | 25 | | 75 | - | - | | |
| OE | 2301451L | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2304497L | Semester-Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 2304498L | Student Outreach Program | - | - | - | - | - | - | | | | |
| | 2304493L | Capstone Portfolio | - | - | - | - | - | - | | | | |
| TOTAL | | | 10 | 4 | | | | | | | 725 | 20 |

*Credits earned in advance through a credit transfer scheme

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| SEMESTER: VII (PART B) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304411T | System Design | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| MDM | *MDM List | Multidisciplinary Minor Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2304491L | Major Project - III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2304499L | Industry Practicum | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| ELC SI | 2304496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| TOTAL | | | 6 | 4 | - | | | | | | 750 | 20 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| COMPUTER ENGINEERING | W. E. F | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: VIII (PART B)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304412T | Cyber Security | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 230442XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2304SWXX | SWAYAM Course* (PEC) | - | - | - | 25 | - | 75 | - | - | | |
| MDM | *MDM List | MDM Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 23XXSWXX | SWAYAM Course* (MDM) | - | - | - | 25 | | 75 | - | - | | |
| OE | 2301451L | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2304497L | Semester-Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 2304498L | Student Outreach Program | - | - | - | - | - | - | | | | |
| | 2304493L | Capstone Portfolio | - | - | - | - | - | - | | | | |
| TOTAL | | | 10 | 4 | | | | | | | 725 | 20 |

*Credits earned in advance through a credit transfer scheme

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | SYSTEM DESIGN |
| | **COURSE CODE** | 2304411T |
| | **COURSE CREDITS** | 4 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 4 | NIL | 60 | NIL | 90 | NIL | NIL | 150 |

**PREREQUISITE : Software Engineering**

**COURSE OBJECTIVES :**

2304411T.CEO.1: 1.To Introduce the fundamental principles of system design, architectural styles, and system types used in modeling real-world applications. .

2304411T.CEO.2: To impart an understanding of human-computer interaction and usability principles to ensure system designs meet user needs effectively.

2304411T.CEO.3: To familiarize with the design process and interaction styles through contextual inquiry and iterative refinement.

2304411T.CEO.4: To explore key concerns in secure, accessible, and ethically responsible system design.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304411T.CO.1: Analyze system design principles to model real-world applications using appropriate architectural styles, system types, and modeling tools.[L4]

2304411T.CO.2: Apply human-computer interaction principles and usability heuristics for effective and user-friendly interfaces for responsive systems.[L3]

2304411T.CO.3: Identify interactive system components using contextual inquiry, iterative design, and interaction styles .[L3]

2304411T.CO.4: Evaluate system designs for security, accessibility, and ethical compliance.[L5]

**COURSE ABSTRACT:**

System Design introduces students to the principles and practices involved in designing scalable, reliable, and user-centered software systems. It covers the end-to-end design process from high-level architecture to low-level component design while integrating essential concepts from Human-Computer Interaction and UI/UX design.The course prepares students to design modern software systems that are not only efficient and robust, but also accessible and user-friendly.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION TO SYSTEM DESIGN & MODELING CENTERED NEEDS** | **10 HOURS** |

**Applications/Case Study:** Online Course Management System,Ride-Sharing App (like Uber),Smart Home Automation System.

**Contents:** Definition and characteristics of system design, Types of systems: Monolithic, Distributed, Microservices, Design considerations: Scalability, reliability, availability, fault tolerance, maintainability, Architectural styles: Layered, Client-server, Microservices, Event-driven, Communication protocols: REST vs WebSockets ,Requirement gathering and UML Modeling.

**Self Study:** Event-Driven Architecture-Role of asynchronous communication,Event sourcing vs. traditional CRUD models.
**Further readings:** Domain-Driven Design (DDD) – Strategic Concepts, Ubiquitous language, Bounded contexts.

| | | |
|---|---|---|
| **UNIT 2** | **USABILITY DESIGN** | **10 HOURS** |

**Applications/Case Study:** Online Food Delivery Platform, E-commerce Website,Messaging App(WhatsApp).

**Contents:**Human-Computer Interaction:Importance,Role, Human Factors in system design :Cognitive and Physical, Ergonomics, Usability, User Interface (UI) principles , Bridging Requirements with UX design:User-centered insights, High Level Design: Performance and Maintainability, Interaction Models in Architecture: Norman's Action Cycle & Gulf of Execution/Evaluation, Aligning system flow with user tasks and feedback loops,Shneiderman's Eight Golden Rules for Interface Design,UI behavior under different architectural choices (real-time vs batch).

**Self Study:** Psychology and the design of Interactive Systems.
**Further Readings:**Agent based Interfaces.

| UNIT 3 | DESIGN PROCESS AND INTERACTION STYLES | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Travel Booking System(MakeMyTrip),Inventory Management UI, Dashboard for IoT Data.

**Contents:** Four Pillars of Design, Process of Design, Ethnographic Observations, ContextualInquiry, Iterative Design, Participatory Design, Navigation Design, Visual Design: Layout, Color,Fonts, Labeling,Scenarios,Interaction Styles:Direct Manipulation, Menu Selection, Form-Filling, Commands, Natural Language, Internationalization, Interaction Design Patterns,HCI in software process: interactive systems and SDLC.

**Self Study:** GOMS(Goals, Operators, Methods, and Selection rules) Keystroke-Level Model:Efficiency in interface actions.

**Further Readings:** Responsive and Adaptive UI Design, UI structure adaptation across devices(desktop, mobile, kiosk).

| UNIT 4 | PERFORMANCE, SCALABILITY AND USABILITY EVALUATION | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Case Study on Live Quiz App,Election Result Dashboard.

**Contents:** System Performance, Scalability-Horizontal vs vertical scaling,load balancing, Content Delivery Network and edge computing for faster content delivery, Caching strategies for UI responsiveness (front-end and back-end), Performance bottlenecks: detection and profiling, Evaluation: Heuristic Evaluation, Cognitive Walkthrough, Expert Reviews, User Surveys, Think Aloud, A/B testing, heatmaps, analytics.

**Self Study:** Case Studies of High-performance systems with good/bad UX.

**Further readings:** Information Architecture.

| UNIT 5 | Security, Accessibility, and Ethical Design in Systems | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Healthcare Portal (HIPAA-compliant system)-Secure UI and audit logging,Social Media Platform-Analysis of ethical concerns (privacy, addiction, content surfacing), Government Service Portal- Accessibility audit and improvement plan

**Contents:** Authentication and Authorization (OAuth2, JWT), Secure UI design (password inputs, feedback handling), Data privacy principles (PII, GDPR, HIPAA), Accessibility in System Design: Importance of inclusive design, WCAG principles (Perceivable, Operable, Understandable, Robust), Designing for diverse user needs (visual, motor, cognitive impairments), Ethics and Responsible Design: Dark patterns vs user-centered design, Designing for transparency and informed consent, Data ethics: What not to collect, when not to personalize etc.

**Self Study:** Common Web Security Vulnerabilities.

**Further Readings:** AI and Ethics in Personalization.

| UNIT 6 | PROTOTYPE DESIGN | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Low Level Design for a Ride-Sharing App Uber/Ola, Chat Application.

**Contents:** Common design patterns (Factory, Singleton, Observer), Connecting UI flows to system functions (LLD-to-UI mapping) , frontend–backend integration principles, state management in UI applications including Redux and Context API, SOLID principles in UI and backend service design.

**Self Study:** Job Scheduling System (e.g., Cron, Airflow): Design classes and interactions.
**Further Readings:** Patterns for Effective Interaction Design.

## TEXT BOOKS


1. Alen Dix,Janet Finlay,Human Computer Interaction,4th Edition,Pearson Publication,ISBN 0130461091
2. Grady Booch, James Rumbaugh, and Ivar Jacobson,The Unified Modeling Language User Guide,Addison Wesley,ISBN 978-0134852157
3. Martin Kleppmann, Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems,O'Reilly
4. Richard N. Taylor, Nenad Medvidovic, Eric Dashofy Software Architecture: Foundations, Theory, and Practice,Wiley,978-0470167748
5. Alex Xu,System Design Interview:An Insider's Guide (Vol 1&2),Publisher:Shroff/bytebytego,979-8664653403


## REFERENCE BOOKS


1. Kent Norman, JurekKirakowski, Handbook of Human Computer Interaction" Wiley Publication,ISBN 9781118976135
2. Martin L. Abbott ,Michael T. Fisher, The Art of Scalability-Scalable Web Architecture, Processes,and Organizations for the Modern Enterprise,Addison Wesely 978-0-13-403280-1.
3. Sam Newman, Building microservices.O'Reilly, ISBN 9789391043384
4. Nick Rozanski Eóin Woods,Software Systems Architecture,ISBN - 978-8131726136
5. Allen I. Hollub, Compiler Design in C, PHI, 2015. ISBN: 978-93-325-4950-0
6. Helen Sharp, Jenifer Preece Interaction Design beyond Human Computer Interaction" 5th Edition, ISBN 978-1119547259
7. Donald Norman, The Design of Everyday Things", 2002 Edition, Basic Books, ISBN 100-465067107
8. Wilbert O. Galitz,The Essential Guide to User Interface Design, 2nd Edition, Wiley-dreamtech India (P) Ltd., ISBN 81-265-0280-0.


## E-RESOURCES

1. Microservices *blog.dreamfactory.com/microservices-examples*
2. Architectural Blueprints: The 4+1 View Model of Software Architecture *https://arxiv.org/abs/2006.04975*
3. Models and Techniques for Ensuring Reliability, Safety, Availability, and Security *https://arxiv.org/pdf/1106.5576*

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Big Data Analytics |
| | **COURSE CODE** | 2304421T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE :** Requires knowledge of Descriptive Analytics, Predictive Analytics

**COURSE OBJECTIVES :**

2304421T.CEO.1: To discuss the significance of big data technologies in data-driven world.
2304421T.CEO.2: To demonstrate usage of big data analytical tools and Map reduce, Apache Spark frameworks.
2304421T.CEO.3: To examine case studies that illustrate big data analytics applications in the health-care, finance, retail domain

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304421T.CO.1: Demonstrate Big Data technologies and Hadoop ecosystem components [L3].
2304421T.CO.2: Apply big data concepts, architectures, and frameworks to solve large-scale data problems. [L3].
2304421T.CO.3: Apply big data technologies, including Pig, Hive, and Apache Spark, to analyze large-scale datasets.[L3].
2304421T.CO.4: Analyze real-world case studies and select appropriate big data tools and frameworks for their resolution.[L4].

**COURSE ABSTRACT:**

This course on Big Data Analytics provides a comprehensive overview of the principles, technologies, and tools used to manage, analyze, and visualize large datasets. Students will explore the characteristics of big data, including its volume, velocity, variety, veracity, and value. Through hands-on projects and real-world case studies, participants will gain experience using popular big data technologies such as Hadoop, Hive, Apache Spark, and NoSQL databases like Habse. By the end of the course, students will be equipped with the skills and knowledge necessary to apply big data analytics in various industries, enabling them to make data-driven decisions

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction To Big Data And Hadoop** | **08 HOURS** |

**Applications/Case Study:** Healthcare Monitoring and cause Detection

**Contents:** Introduction to Big Data, Sources of Big Data, 5 V's of Big Data, Big Data Analytics, Challenges of Traditional System, Challenges of Big data, Distributed Systems, Introduction to Apache Hadoop, Hadoop Features, Components of Hadoop Ecosystem, Hadoop Architecture, Commercial Hadoop Distributions.

**Self Study:** Environmental Setup and Custer management of Hadoop

**Further Readings:** Hadoop Security Architecture .

| | | |
|---|---|---|
| **UNIT 2** | **HDFS (Hadoop Distributed File System)** | **06 HOURS** |

**Applications/Case Study:** Retail Analytics with HDFS.

**Contents:** Introduction to HDFS, Features and Goals, Internal Architecture and HDFS Workflow, HDFS Concepts, Command Line Interface (CLI), Hadoop file system interfaces, HDFS File Operations, YARN Components, Benefits of YARN,Data flow, Data Ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: Compression, Serialization - Avro, parquet, File-Based Data structures.

**Self Study:** Performance Evaluation in HDFS.

**Further Readings:** HDFS architecture in cloud computing.

| | | |
|---|---|---|
| **UNIT 3** | **Map Reduce Framework** | **06 HOURS** |

**Applications/Case Study:** Search: Web Indexing.

**Contents:** Introduction to MapReduce, Framework, Compilation and Execution Process Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map-Reduce Types and Formats, Map Reduce Features. MapReduce Use Cases. Input Splits, Relation between Input Splits and HDFS Blocks Combiner Practitioner.

**Self Study:** Map Reduce versus Spark.

**Further Readings:** Map reduce in Cloud Computing.

| UNIT 4 | Apache Pig and Hive | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Sentiment Analysis on social media.

**Contents: Apache Pig -** Introduction to PIG, Execution Modes of Pig, Pig-Latin Grunt, Pig data types, Load and Store operations. The Pig operators- Diagnostics Operators, Data Processing operators, Relational Operators, Group Operator, Joins, Union in Pig, Built In Functions (Eval, Math, String, Date).

**Apache Hive -** Introduction to Hive, Hive Shell, Hive Services, Hive Metastore, Hive DDL and DML, Hive Databases, creating new table, Basics and Internal Table, external table, Loading Different File Formats, Load Data Into Hive Table, Hive Indexes and View, Hive Partitions Buckets, Hive Function Built-in User Defined Functions.

HiveQL: Simple Operations On Hive Table, query operations on hive table, Querying Complex Structures From A Table, Join Sub-Query.

**Self Study:** Difference between Pig and Hive. Technology Comparison with Traditional Databases.

**Further Readings:** Hive ETL

| UNIT 5 | Hadoop Databses - Apache HBase, Cassandra, CouchDB | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Financial Services Analytics with HBase.

**Contents:** Apache HBase: Introduction, Concepts, HBase Vs RDBMS, HBase prerequisites, Base Architecture, Components, and Data Model, HBase Shell Commands, HBase Table operations, Create, Insert Retrieve Data in HBase, Using Apache HBase Shell, Conceptual Physical View, Name-space, Tables, Rows, Cells Column Family, Sort Order, Column Metadata, joins, ACID, Schema Design,Row Key design,Constraints,Catalog Tables, Storing Medium-sized Objects, Backup and Restore commands. Introduction to Cassandra, CouchDB.

**Self Study:** NoSQL Databases

**Further Readings:** NoSQL Databases integration in cloud technology.

| UNIT 6 | Apache Spark | 09 HOURS |
|---|---|---|

**Applications/Case Study:** Recommender systems.

**Contents:** Introduction, Spark Architecture, Spark Cluster Architecture, Spark Master and Worker node Service, Spark DAG, Spark Executor Spark core programming concepts, compilation and execution of spark program. Resilient distributed databases (RDD),

Introduction to Spark Data Frames, Data Frames Overview, Spark Data Frame Operations, Group By and Aggregate Functions, Missing data, Date and Timestamps.

**Self Study:** Hadoop MapReduce Vs Apache Spark.

**Further Readings:** Mobile big data analysis using Apache Spark.

## TEXT BOOKS


1. DT Editorial Services. (2016). *Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization*. 1st Edition, Dreamtech Press. ISBN: 978-8184891430.
2. Tom White.(2016). *Hadoop: The Definitive Guide*. 4th Edition, O'Reilly. ISBN: 978-9352130672.
3. Lars George. (2011). *HBase: The Definitive Guide - Random Access to Your Planet-Size Data*. 1st Greyscale Indian Edition, O'Reilly. ISBN:978-9350235034.
4. Bill Chambers.(2018). *Spark: The Definitive Guide - Big Data Processing Made Simple* . 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9352137060.


## REFERENCE BOOKS


1. Dipak Vohra (2016). *Practical Hadoop Ecosystem:A Definitive Guide to Hadoop Frameworks and Tool*. 1st Edition, A-Press, ISBN: 978-1484221983.
2. Arshdeep Bahga, Vijay Madisetti. (2016). *Big Data Science Analytics: A Hands-On Approach*. 1st Edition, VPT, ISBN: 978-0996025546.
3. Vaddeman, Balaswamy. (2018). *Beginning Apache Pig*. 1st Berkeley, CA: Apress. ISBN: 978-1484223369.
4. Holden Karau, Rachel Warren. (2017). *Beginning Apache Pig*. 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9352135615.
5. Mamta Mittal , Valentina E. Balas , Lalit Mohan Goyal, Raghvendra Kumar. (2018). *Big data processing using spark in cloud.*. 1st Edition, Springer Verlag. ISBN: 978-9811344480.


## E-R ESOURCES

1. https://hadoop.apache.org/docs/stable/
2. https://nptel.ac.in/courses/106104189

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2025 - 2026 (Rev. (NEP)) |
| FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Big Data Analytics Lab |
| | COURSE CODE | 2304421L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Requires knowledge of Descriptive Analytics, Predictive Analytics

**COURSE OBJECTIVES :**

2304421L.CEO.1: To explore the significance of big data technologies in data-driven world.
2304421L.CEO.2: To demonstrate usage of Bigdata frameworks Map reduce, Apache Spark to perform analytics over large datasets.
2304421L.CEO.3: To illustrate usage of analytical tools and ecosystem componemts like Pig, Hive, Hbase etc.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304421L.CO.1: Apply big data tools and frameworks (e.g., Hadoop, Map Reduce, Spark) to process large datasets. [L3].
2304421L.CO.2: Analyze large datasets using technologies pig, hive, Apache spark, etc.[L4].
2304421L.CO.3: Evaluate real-world case studies using big data implementations. [L5].
2304421L.CO.4: Develop visualization and dashboards to interpret and communicate analytical results effectively [L3].

**COURSE ABSTRACT:**

This course on Big Data Analytics provides a comprehensive overview of the principles, technologies, and tools used to manage, analyze, and visualize large datasets. Students will explore the characteristics of big data, including its volume, velocity, variety, veracity, and value. Through hands-on projects and real-world case studies, participants will gain experience using popular big data technologies such as Hadoop, Hive, Apache Spark, and NoSQL databases like Habse. By the end of the course, students will be equipped with the skills and knowledge necessary to apply big data analytics in various industries, enabling them to make data-driven decisions.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Hadoop Installation and Commands** | **4 HOURS** |
| A. Installation of the Hadoop under windows 10/ Linux (Min. 2 GBRAM)/ Virtual Machines or Hadoop Distribution of Cloudera (Min Requirement 8 GB RAM)<br>B. Execution of basic Hadoop Commands | | |
| **PRACTICAL NO.02** | **Map Reduce Framework** | **4 HOURS** |
| Implementation of Word Count program using Map Reduce Framework. | | |
| **PRACTICAL NO.03** | **Apache Pig** | **4 HOURS** |
| Apache PIG exercises using Given dataset Create two file as fil11.txt and file2.txt, Insert students details (least 10 records) like (rollno, name, age, city, etc) but not limited to, and perform following operations 1. Load the files using PigStorage<br>2. Perform task using Diagnostic Operator - Dump operator,Describe operator,Explain operator, Illustration operator<br>3. Grouping and Joining - Group Operator, Cogroup Operator, Join Operator,Cross Operator<br>4. Combining Splitting - Union Operator, Split Operator<br>5. Filtering - Filter Operator, Distinct Operator, Foreach Operator<br>6. Sorting - Order By, Limit Operator<br>7. Built-in Functions | | |
| **PRACTICAL NO.04** | **Apache Hive** | **4 HOURS** |
| Apache Hive: DDL, DML Statement using Apache Hive Execution of Given Queries on various dataset. | | |
| **PRACTICAL NO.05** | **Apache HBase** | **4 HOURS** |
| Apache HBase: DDL, DML Operations, HBase Operations- read and Write using Metatable. | | |
| **PRACTICAL NO.06** | **Apache Spark** | **4 HOURS** |
| Social Media (Facebook/witter) Analysis using Spark. | | |
| **MINI PROJECTS** | **For Practical Exam** | **6 HOURS** |
| Students need to complete mini project which will be evaluated under Practical Exam. | | |

## TEXT BOOKS


1. DT Editorial Services. (2016). *Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization*. 1st Edition, Dreamtech Press. ISBN: 978-8184891430.
2. Tom White.(2016). *Hadoop: The Definitive Guide*. 4th Edition, O'Reilly. ISBN: 978-9352130672.
3. Lars George. (2011). *HBase: The Definitive Guide - Random Access to Your Planet-Size Data*. 1st Greyscale Indian Edition, O'Reilly. ISBN:978-9350235034.
4. Bill Chambers.(2018). *Spark: The Definitive Guide - Big Data Processing Made Simple* . 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9352137060.


## REFERENCE BOOKS


1. Dipak Vohra (2016). *Practical Hadoop Ecosystem:A Definitive Guide to Hadoop Frameworks and Tool*. 1st Edition, A-Press, ISBN: 978-1484221983.
2. Arshdeep Bahga, Vijay Madisetti. (2016). *Big Data Science Analytics: A Hands-On Approach*. 1st Edition, VPT, ISBN: 978-0996025546.
3. Vaddeman, Balaswamy. (2018). *Beginning Apache Pig*. 1st Berkeley, CA: Apress. ISBN: 978-1484223369.
4. Holden Karau, Rachel Warren. (2017). *Beginning Apache Pig*. 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9352135615.
5. Mamta Mittal , Valentina E. Balas , Lalit Mohan Goyal, Raghvendra Kumar. (2018). *Big data processing using spark in cloud.*. 1st Edition, Springer Verlag. ISBN: 978-9811344480.


## E-R ESOURCES

1. https://hadoop.apache.org/docs/stable/
2. https://nptel.ac.in/courses/106104189

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Generative Artificial Intelligence |
| | **COURSE CODE** | 2304422T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | 0.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Machine Learning, Deep Learning.

**COURSE OBJECTIVES :**

2304422T.CEO.1: Understand principles of generative models.
2304422T.CEO.2: Develop practical skills in building and deploying generative AI models.
2304422T.CEO.3: Analyze ethical considerations and impacts of generative AI in different fields.
2304422T.CEO.4: Explore advanced models such as GANs, VAEs, Diffusion Models, and Transformer-based architectures.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304422T.CO.1: Develop Generative AI models and diffusion models to generate data across various domains like images, text, and music [L3].
2304422T.CO.2: Use industry-standard tools and platforms for building, deploying, and scaling generative AI models [L3].
2304422T.CO.3: Analyze the performance of Generative AI models for real world applications [L4].
2304422T.CO.4: Determine the ethical challenges posed by generative AI technologies, including bias, misinformation, and intellectual property concerns [L5].

**COURSE ABSTRACT:**

This advanced course in Generative AI explores the theoretical underpinnings and practical implementations of AI models capable of generating original content. Leveraging foundational knowledge from Artificial Intelligence and Machine Learning and Deep Learning, students will delve into the architecture, training, and application of generative models, including Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Transformer-based models such as GPT.

Through hands-on projects and case studies, students will learn to design, implement, and evaluate generative models for tasks such as image synthesis, text generation, and style transfer. Emphasis is placed on understanding the ethical implications and potential biases of generative AI, as well as methods to mitigate risks in applications. By the end of the course, students will have practical expertise in deploying generative models and insights into emerging applications across industries.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Generative AI** | **08 HOURS** |

**Applications/Case Study:** AI-Generated Music:Open AI's Jukebox, Text Generation:AI Dungeon

**Contents:** Overview of AI and generative models. Difference between discriminative and generative models. Applications of generative models (art, music, image generation, etc.). Historical context of generative models. Large Language Models.

**Further Readings:** Interactive Generative Systems

| | | |
|---|---|---|
| **UNIT 2** | **Autoencoders and Variational Autoencoders (VAE)** | **09 HOURS** |

**Applications/Case Study:** Medical Imaging, Anomaly Detection, Customer Segmentation and Recommendations

**Contents:** Introduction to Autoencoders (AE): Encoder, Decoder, Applications (Data Compression, Denoising). Variational Autoencoders (VAE): KL divergence, reparameterization trick, latent space exploration.

**Self Study:** Limitations of AEs and VAEs (overfitting, interpretability)

| | | |
|---|---|---|
| **UNIT 3** | **Generative Adversarial Networks (GANs)** | **08 HOURS** |

**Applications/Case Study:** Synthetic Medical Imaging Data, Deepfake Creation and Detection.

**Contents:** Introduction to GANs: Generator and Discriminator structure, Adversarial loss, Minimax optimization. Types of GANs: Vanilla GAN, Deep Convolutional GANs (DCGAN), Conditional GANs, Progressive Growing GAN. Challenges in GAN Training: Mode collapse, vanishing gradients.

**Further Readings:** Style Transfer and Creativity in Design: StyleGAN, CycleGAN

| UNIT 4 | Transformer-based Generative Models | 08 HOURS |
|---|---|---|

**Applications/Case Study:** OpenAI GPT-3, DALL-E and DALL-E 2, BERT.
**Contents:** Introduction to Transformers: Self-attention mechanism, Positional encoding. Transformer-based Generative Models: GPT (GPT-2, GPT-3), BERT for generative tasks. Text-to- Image Synthesis, Vision Transformers (ViT) and generative applications in image generation.

**Further Readings:** Creative Industries: Content Creation in Art, Music, and Design.

| UNIT 5 | Diffusion Models | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Medical Imaging Enhancement, Automotive Design and Simulation
**Contents:** Introduction to Denoising Diffusion Probabilistic Models (DDPM). Producing high-quality, diverse outputs in image, video, and text generation
Iterative and probabilistic approach: Forward diffusion (adding noise) and reverse process (denoising)

**Self Study:** Multimodal Models

| UNIT 6 | Ethical, Societal, and Legal Dimensions of Generative AI | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Medical Imaging Enhancement, Automotive Design and Simulation
**Contents: Ethics:** Fairness, transparency, accountability, bias mitigation, privacy, and human-AI collaboration in global and Indian contexts.
**Society:** Misinformation, job displacement, cultural diversity, trust restoration, and applications in education and healthcare worldwide and in India.
**Policy Law:** EU AI Act, General Data Protection Regulation, India's IT Act, Data Protection Bill, copyright, intellectual property, liability, and AI governance frameworks.
**Security Sustainability:** Deepfakes, misuse prevention, energy efficiency, carbon footprint, Paris Agreement, and National AI Strategy (NITI Aayog).

**TEXT BOOKS**


1. Jozefowicz, R., Zaremba, W., Sutskever, I. (2023). An Introduction to Generative Models with Applications. Cambridge University Press.
2. Choi, H., Kim, J. (2023). Generative AI: A Practical Guide to Applications and Ethics. Springer.
3. Liu, L., Xu, H. (2020). Generative deep learning: Teaching machines to paint, write, compose, and play. O'Reilly Media.
4. Goodfellow, I., Bengio, Y., Courville, A. (2016). Deep learning. MIT Press. https://www.deeplearningbook.org/

## REFERENCE BOOKS


1. Ramesh, A., Pavlov, M., Goh, G., et al. (2022). DALL•E: Creating images from text. OpenAI. Retrieved from https://openai.com/research/dall-e
2. Lee, J., Kim, J. (2023). Generative AI for Software Engineering: Techniques and Tools. CRC Press.


## E-LEARNING RESOURCES

1. Swayam Course on Generative AI and Large Language Models, By Naveen Kumar Bhansali, Indian Institute of Management Bangalore (IIMB).
2. OpenAI. (n.d.). Research and blog on AI advancements. Retrieved from https://www.openai.com/blog.
3. Coursera. (n.d.). Generative adversarial networks (GANs) specialization by DeepLearning.AI. Coursera. Retrieved from https://www.coursera.org

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. (NEP) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Generative Artificial Intelligence LAB |
| | **COURSE CODE** | 2304422L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | 0.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Machine Learning, Deep Learning.

**COURSE OBJECTIVES :**

2304422L.CEO.1: Develop practical skills in building and deploying generative AI models.
2304422L.CEO.2: Analyze ethical considerations and impacts of generative AI in different fields.
2304422L.CEO.3: Explore advanced models such as Generative Adversarial Networks , Variational Autoencoders, Diffusion Models, and Transformer-based architectures.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304422L.CO.1: Analyze Generative AI models and diffusion models to generate data across various domains like images, text, and music [L4].
2304422L.CO.2: Evaluate the performance of Generative AI models for real world applications [L5].
2304422L.CO.3: Deploy generative AI for practical applications such as image synthesis, data augmentation, and creative content generation [L6].

**COURSE ABSTRACT:**

This advanced course in Generative AI explores the theoretical underpinnings and practical implementations of AI models capable of generating original content. Leveraging foundational knowledge from Artificial Intelligence and Machine Learning and Deep Learning, students will delve into the architecture, training, and application of generative models, including Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Transformer-based models such as GPT.

Through hands-on projects and case studies, students will learn to design, implement, and evaluate generative models for tasks such as image synthesis, text generation, and style transfer. Emphasis is placed on understanding the ethical implications and potential biases of generative AI, as well as methods to mitigate risks in applications. By the end of the course, students will have practical expertise in deploying generative models and insights into emerging applications across industries.

**PRACTICAL EXPERIMENTS**

| | | |
|---|---|---|
| **PRACT 1** | **Introduction to Generative AI** | **04 HOURS** |

**Practical Experiment:**

1. Setting Up the Environment for Generative AI and Make use of generative models for creative content generation.
2. Implement simple probabilistic models like Gaussian Mixture Models.

| | | |
|---|---|---|
| **PRACT 2** | **Autoencoders and Variational Autoencoders (VAE)** | **04 HOURS** |

**Practical Experiment**

1. Build a simple AE model for Dimensionality Reduction and Denoising.
2. Generate realistic faces or interpolate between facial features for creative applications in entertainment and design using VAE.

| | | |
|---|---|---|
| **PRACT 3** | **Generative Adversarial Networks (GANs)** | **04 HOURS** |

**Practical Experiment:** Implement a DCGAN and/or cGAN on a chosen dataset to generate original image data, providing a comprehensive summary of the GAN architectures, training processes, and generated results. Conduct a comparative analysis of the models, evaluating their effectiveness in image quality and consistency. Conclude with a presentation that includes a case study analysis, discussing ethical considerations and challenges in real-world GAN applications.

| | | |
|---|---|---|
| **PRACT 4** | **Transformer-based Generative Models** | **04 HOURS** |

**Practical Experiment:**

1. Generate coherent and contextually relevant text using GPT models.
2. Create images based on text prompts using a text-to-image model to explore Transformer capabilities in multimodal tasks.

| PRACT 5 | Diffusion Models | 04 HOURS |
|---|---|---|

**Practical Experiment:** Implement a basic diffusion model for image generation by simulating the process of adding and removing noise. Use a pre-trained diffusion model to generate images from text prompts and compare results, highlighting model strengths, limitations, and ethical considerations.

| PRACT 6 | Generative AI in Action: The Capstone Experience | 10 HOURS |
|---|---|---|

This Lab Experiment serves as the culmination of the Generative AI course, where students apply their acquired knowledge and skills to develop a capstone project that demonstrates innovative use of generative models. Students will work in teams to ideate, design, and implement a project that addresses a real-world challenge or explores a creative application of generative AI. Learning Outcomes:

1. Formulate a project proposal based on identified needs or creative ideas in the field of Gen AI.
2. Collaborate effectively in teams to execute a Gen AI project.
3. Implement, Analyze and Evaluate a Gen AI model using appropriate methodologies and tools.
4. Communicate project outcomes through a detailed report/article and a professional presentation.

## TEXT BOOKS


1. Jozefowicz, R., Zaremba, W., Sutskever, I. (2023). An Introduction to Generative Models with Applications. Cambridge University Press.
2. Choi, H., Kim, J. (2023). Generative AI: A Practical Guide to Applications and Ethics. Springer.
3. Liu, L., Xu, H. (2020). Generative deep learning: Teaching machines to paint, write, compose, and play. O'Reilly Media.
4. Goodfellow, I., Bengio, Y., Courville, A. (2016). Deep learning. MIT Press. https://www.deeplearningbook.org/


## REFERENCE BOOKS


1. Ramesh, A., Pavlov, M., Goh, G., et al. (2022). DALL•E: Creating images from text. OpenAI. Retrieved from https://openai.com/research/dall-e
2. Lee, J., Kim, J. (2023). Generative AI for Software Engineering: Techniques and Tools. CRC Press.


## E-L EARNING RESOURCES

1. Swayam Course on Generative AI and Large Language Models, By Naveen Kumar Bhansali, Indian Institute of Management Bangalore (IIMB).
2. OpenAI. (n.d.). Research and blog on AI advancements. Retrieved from https://www.openai.com/blog.
3. Coursera. (n.d.). Generative adversarial networks (GANs) specialization by DeepLearning.AI. Coursera. Retrieved from https://www.coursera.org

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | CLOUD NATIVE DEVOPS |
| | **COURSE CODE** | 2304423T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE :** Requires knowledge of Cloud Computing Foundations Cloud Native Application Development

**COURSE OBJECTIVES :**

2304423T.CEO.1: To explain the historical development of DevOps, and focusing on its role in bridging the gap between development and operations teams.
2304423T.CEO.2: To guide students in understanding the architecture, fundamental concepts, and essential components of Ansible.
2304423T.CEO.3: To equip students with the skills to build, manage, and deploy Docker containers
2304423T.CEO.4: To prepare students to set up and configure a Kubernetes cluster on AWS
2304423T.CEO.5: To train students to monitor and troubleshoot CI/CD pipelines in Jenkins.
2304423T.CEO.6: To develop students' ability to write Terraform configuration files.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304423T.CO.1: Describe the benefits of adopting DevOps practices in development.[L2]
2304423T.CO.2: Apply Ansible's automation of system configuration and deployment.[L3]
2304423T.CO.3: Deploy scalable, available containerized applications on AWS.[L3]
2304423T.CO.4: Analyze the architecture and components of Kubernetes within an AWS environment.[L4]
2304423T.CO.5: Evaluate CI/CD pipelines in Jenkins for software workflows.[L5]
2304423T.CO.6: Analyze the Terraform configuration files within an AWS environment.[L4]

**COURSE ABSTRACT:**

The Cloud Native DevOps course provides an in-depth exploration of modern development and operational practices designed for cloud-native environments. It covers key concepts, tools, and methodologies such as containerization, microservices, CI/CD pipelines, infrastructure as code, and observability. Participants will learn to build, deploy, and manage scalable, resilient, and automated applications using platforms like Kubernetes, Docker, and cloud services (e.g., AWS). Emphasizing hands-on learning, the course equips learners with skills to streamline workflows, optimize performance, and foster collaboration between development and operations teams, ensuring robust and agile cloud-native solutions.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Devops** | **07 HOURS** |

**Applications/Case Study:** Tech Solutions

**Contents:** DevOps: Introduction, Features, Architecture, Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI/CD.

**Self Study:** DevOps vs Traditional IT Practices

**Further Readings:** DevOps Case Studies.

| | | |
|---|---|---|
| **UNIT 2** | **Conftguration Management: Ansible** | **08 HOURS** |

**Applications/Case Study:** FinTechCorp

**Contents:** Introduction to Ansible and Configuration Management, Ansible Inventory and Ad-Hoc Commands, Writing Ansible Playbooks, Advanced Playbook Features, Roles, and Best Practices

**Self Study:** Ansible Architecture.

**Further Readings:** Ansible in CI/CD Pipelines.

| | | |
|---|---|---|
| **UNIT 3** | **Containerization : Docker** | **08 HOURS** |

**Applications/Case Study:** CloudApps Inc.

**Contents:** Introduction to Docker and Containers, Working with Docker Images and Dockerfile, Docker Compose and Multi-Container Applications, Docker on AWS (ECS, ECR, and Fargate), Container Orchestration and Scaling with AWS ECS and Fargate, Docker Security and Best Practices in AWS.

**Self Study:** Docker Architecture.

**Further Readings:** Docker Monitoring and Logging.

| UNIT 4 | Kubernetes | 07 HOURS |
|---|---|---|

**Applications/Case Study:** AppTech Solutions

**Contents:** Introduction to Kubernetes and AWS EKS, Kubernetes architecture, Core Kubernetes Concepts and Networking in AWS EKS, Storage, Monitoring, and Logging in Kubernetes on AWS, Security, Scaling, and Best Practices in AWS EKS.

**Self Study:** Kubernetes Configuration Management

**Further Readings:** Advanced Kubernetes Features

| UNIT 5 | CI/CD using Jenkins | 07 HOURS |
|---|---|---|

**Applications/Case Study:** RetailTech Solutions

**Contents:** Introduction to CI/CD and Jenkins Basics, Jenkins Job Configuration and Pipeline Creation, Advanced Jenkins Pipelines and Integration with Tools, Continuous Deployment and Best Practices.

**Self Study:** Building and Testing with Jenkins.

**Further Readings:** Security in Jenkins.

| UNIT 6 | Resource provisioning using Terraform | 08 HOURS |
|---|---|---|

**Applications/Case Study:** CloudServe Inc.

**Contents:** Introduction to Infrastructure as Code (IaC) and Terraform Basics, Building AWS Infrastructure with Terraform, Advanced Terraform Features and AWS Resource Provisioning, Terraform Best Practices, Automation, and Security.

**Self Study:** State Management in Terraform.

**Further Readings:** Terraform Testing and Validation.

## TEXT BOOKS


1. Wittig, Michael, Andreas Wittig, and Ben Whaley (2018). *Amazon web services in action*.
2. Raheja, Yogesh, Giuseppe Borgese, and Nathaniel Felsen. *Elective DevOps with AWS: Imple-ment continuous delivery and integration in the AWS environment*. Packt Publishing Ltd, 2018.
3. Vehent, Julien. *Securing DevOps: security in the cloud*. Simon and Schuster, 2018.
4. Sarkar, Aurobindo, and Amit Shah. *Learning AWS: Design, build, and deploy responsive applications using AWS Cloud components*. Packt Publishing Ltd, 2018.


## REFERENCE BOOKS


1. Kavis, Michael J. *Architecting the cloud: design decisions for cloud computing service models (SaaS, PaaS, and IaaS)*. John Wiley Sons, 2014.
2. Vacca, John R., ed. *Cloud computing security: foundations and challenges*. CRC Press, 2016.
3. Furht, Borivoje, and Armando Escalante. *Handbook of cloud computing*. Vol. 3. New York: springer, 2010.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev. (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | CLOUD NATIVE DEVOPS LAB |
| | COURSE CODE | 2304423L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : 2304223 | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Requires knowledge of Cloud Computing Foundations, Cloud Native Application Development

**COURSE OBJECTIVES :**

2304423L.CEO.1: To explain the historical development of DevOps, and focusing on its role in bridging the gap between development and operations teams.
2304423L.CEO.2: To guide students in understanding the architecture, fundamental concepts, and essential components of Ansible.
2304423L.CEO.3: To equip students with the skills to build, manage, and deploy Docker containers
2304423L.CEO.4: To prepare students to set up and configure a Kubernetes cluster on AWS
2304423L.CEO.5: To train students to monitor and troubleshoot CI/CD pipelines in Jenkins.
2304423L.CEO.6: To develop students' ability to write Terraform configuration files.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304423L.CO.1: Deploy scalable, available containerized applications on AWS.[L3]
2304423L.CO.2: Analyze the architecture and components of Kubernetes within an AWS environment.[L4]
2304423L.CO.3: Evaluate CI/CD pipelines in Jenkins for software workflows.[L5]
2304423L.CO.4: Analyze the Terraform configuration files within an AWS environment.[L4]

**COURSE ABSTRACT:**

The Cloud Native DevOps course provides an in-depth exploration of modern development and operational practices designed for cloud-native environments. It covers key concepts, tools, and methodologies such as containerization, microservices, CI/CD pipelines, infrastructure as code, and observability. Participants will learn to build, deploy, and manage scalable, resilient, and automated applications using platforms like Kubernetes, Docker, and cloud services (e.g., AWS). Emphasizing hands-on learning, the course equips learners with skills to streamline workflows, optimize performance, and foster collaboration between development and operations teams, ensuring robust and agile cloud-native solutions.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Ansible Inventory and Ad-Hoc Commands.** | **4 HOURS** |

- Install Ansible and verify the installation.
- Setup SSH keys and run basic Ansible commands to test the connection.
- Configure an inventory file and run Ad-Hoc commands.
- Perform operations like starting/stopping services, installing packages on managed nodes.

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|---|---|---|
| **PRACTICAL NO.02** | **Ansible Playbooks.** | **2 HOURS** |

- Write a basic playbook to automate the installation of Apache HTTP server and start the service.
- Create tasks to manage configuration files.
- Create roles to manage a multi-tier application.
- Secure credentials with Ansible Vault.

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| **PRACTICAL NO.03** | **Docker Images and Dockerftle.** | **4 HOURS** |

- Install Docker on your machine
- Create a custom Dockerfile to build a basic Node.js or Python application.
- Build and run the custom image.
- Launch and manage the containers using Docker Compose commands.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Docker on AWS.** | **4 HOURS** |

- Push a custom Docker image to Amazon ECR.
- Create an ECS cluster and define a task to run the container.
- Deploy a containerized application using AWS Fargate.
- Secure Docker containers by applying resource constraints.

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **Core Kubernetes Concepts and Networking in AWS EKS.** | **2 HOURS** |

- Set up an AWS EKS cluster using eksctl.
- Launch and configure worker nodes for the EKS cluster.
- Deploy a sample application (e.g., Nginx or Node.js) on the EKS cluster.
- Expose the application using a Kubernetes Service with an AWS ELB.

| PRACTICAL NO.06 | Storage, Monitoring, and Logging in Kubernetes on AWS. | 4 HOURS |
|---|---|---|
| • Deploy a stateful application (e.g., MySQL) with Persistent Volumes using AWS EBS.<br>• Set up Cloud Watch monitoring and logs for an EKS cluster.<br>• Use Prometheus and Grafana to monitor the Kubernetes cluster.<br>• Configure Horizontal Pod Autoscaler (HPA) and Cluster Autoscaler for an application. | | |
| **PRACTICAL NO.07** | **Jenkins Job Conftguration and Pipeline Creation.** | **4 HOURS** |
| • Install Jenkins on a local machine or cloud instance.<br>• Explore Jenkins' user interface and configure basic settings.<br>• Create and configure a Freestyle project to pull code from GitHub and run a build.<br>• Write a simple Jenkins pipeline using the Pipeline Syntax. | | |
| **PRACTICAL NO.08** | **Advanced Jenkins Pipelines and Integration with Tools.** | **2 HOURS** |
| • Create an advanced Jenkins pipeline with stages: Build, Test, Package, and Deploy.<br>• Integrate Jenkins with Maven or npm to automate the build process.<br>• Build a Docker image using a Jenkins pipeline and push it to Docker Hub.<br>• Deploy the Dockerized application to a cloud provider (AWS EC2, Google Cloud, etc.). | | |
| **PRACTICAL NO.09** | **Building AWS Infrastructure with Terraform.** | **2 HOURS** |
| • Install Terraform and configure it to interact with AWS.<br>• Write a basic Terraform configuration file to launch an AWS EC2 instance.<br>• Storing Terraform state locally vs. remotely (e.g., in S3).<br>• State management commands: terraform show, terraform state list, terraform state rm. | | |
| **PRACTICAL NO.10** | **Advanced Terraform Features and AWS Resource Provisioning.** | **2 HOURS** |
| • Use a Terraform module to provision a VPC with subnets, route tables, and an internet gateway.<br>• Use data sources to find an AMI and launch an EC2 instance within the created VPC.<br>• Automate the creation of an Auto Scaling Group with a Load Balancer and attach instances dynamically.<br>• Set up a Terraform workspace for managing multiple environments (development, staging, production).<br>• Automate the provisioning of resources using a CI/CD pipeline (e.g., Jenkins with Terraform). | | |

## TEXT BOOKS


1. Wittig, Michael, Andreas Wittig, and Ben Whaley (2018). *Amazon web services in action*.
2. Raheja, Yogesh, Giuseppe Borgese, and Nathaniel Felsen. *Elective DevOps with AWS:Imple-ment continuous delivery and integration in the AWS environment*. Packt Publishing Ltd,2018.
3. Vehent, Julien. *Securing DevOps: security in the cloud*. Simon and Schuster, 2018.
4. Sarkar, Aurobindo, and Amit Shah. *LearningAWS:Design, build, and deploy responsive applications using AWS Cloud components*. Packt Publishing Ltd, 2018.


## REFERENCE BOOKS


1. Kavis, Michael J. *Architecting the cloud: design decisions for cloud computing service models (SaaS, PaaS, and IaaS)*. John Wiley Sons, 2014.
2. Vacca, John R., ed.*Cloud computing security: foundations and challenges*. CRC Press, 2016.
3. Furht, Borivoje, and Armando Escalante. *Handbook of cloud computing*. Vol. 3. New York: springer, 2010.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Ethical Hacking and Cyber Laws |
| | **COURSE CODE** | 2304424T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE :** Cryptography and System Security, Cyber Security and Forensic

**COURSE OBJECTIVES :**

2304424T.CEO.1: Equip learners with the knowledge of common hacking techniques, including penetration testing, vulnerability analysis, and exploit discovery.

2304424T.CEO.2: To gather detailed information about a target system or network, including IP addresses, domain names, and network infrastructure.

2304424T.CEO.3: Identify the weaknesses in systems and networks before malicious actors exploit them with the help of vulnerability assessment methods.

2304424T.CEO.4: Explain the privilege escalation technique and gain access to a targeted system.

2304424T.CEO.5: Identify different web server attacks and countermeasures.

2304424T.CEO.6: To understand the step-by-step methodology used in web application hacking

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304424T.CO.1: Identify the hacking concepts, techniques, and scopes [L3].
2304424T.CO.2: Experiment with the digital footprint technique to better understand the system's structure, and detect vulnerabilities. [L3].
2304424T.CO.3: Identify, quantify, and prioritize vulnerabilities in a system, network, or application in order to analyze its security weaknesses and potential risks [L4].
2304424T.CO.4: Apply different techniques to privilege escalation and gain access to a system [L3].
2304424T.CO.5: Analyze various web server attacks and their countermeasures[L4].
2304424T.CO.6: Classify different techniques to perform various web application and mobile application attacks [L4].

**COURSE ABSTRACT:**

The Ethical Hacking Course provides hands-on experience in identifying, exploiting, and mitigating cybersecurity vulnerabilities. Participants use real-world tools and techniques to conduct penetration testing, vulnerability assessments, and simulated attacks on networks, systems, and web applications. The course emphasizes ethical hacking principles, legal considerations, and developing skills to safeguard organizational assets from malicious threats. Through practical exercises, learners gain proficiency in offensive and defensive cybersecurity strategies, preparing them for roles in ethical hacking, network security, and incident response.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Security Foundations** | **06 HOURS** |

**Applications/Case Study:** Case study on Ethical Hacking Methodology
**Contents:** Overview of Ethics and hacking, Attack Modeling, Methodology of Ethical hacking, Information Assurance and Risk, Policies, Standards, and Procedures, organizing your protections, and security technology.
**Self Study:** Ethical hacking phases
**Further Readings:** Risk assessment and management.

| | | |
|---|---|---|
| **UNIT 2** | **Footprinting and Reconnaissance** | **06 HOURS** |

**Applications/Case Study:** Demonstration to gather the information of targeted system
**Contents:** Footprinting: Concept, Footprinting through search engines, Web services, Social Networking Sites, Websites, email, Social engineering, Whois, DNS. Footprinting Countermeasures Scanning Networks: Network Scanning Concepts, Scanning Tools, Port and Service Discovery, OS Discovery, Vulnerability Scanning, packet crafting and manipulation.
**Self Study:**Nmap Scanning techniques.
**Further Readings:**Banner grabbing using scanning tools.

| UNIT 3 | Vulnerability Analysis | 06 HOURS |
|---|---|---|
| **Applications/Case Study:** Demonstration NESSUS tool for Vulnerability Assessment<br>**Contents:** Vulnerability Assessment Concepts, Classification and Assessment Types, Assessment Solutions and Tools, Assessment Reports<br>**Self Study:** Explore the different methods in NESSUS/Acunetix, Burp Suite.<br>**Further Readings:** Generate the Vulnerability Assessment Report on the web application. | | |
| **UNIT 4** | **System Hacking** | **08 HOURS** |
| **Applications/Case Study:** Demonstration on Social Engineering technique using Kali Linux<br>**System Hacking Concepts:** Searching for Exploits, Gathering passwords, password cracking, client-side vulnerabilities, Sniffing, Social Engineering, and Denial of Services.<br>**Self Study:** DDoS Attack and preventation methods.<br>**Further Readings:** Methods of authentication bypass | | |
| **UNIT 5** | **Hacking Web Servers** | **08 HOURS** |
| **Applications/Case Study:** Case study on web server attack<br>**Contents:** Web server Concepts, Web Server attacks, webserver attack methodology, web server attack tools, Countermeasures, patch management, web server security tools.<br>**Self Study:** Explore web security tools in Kali Linux.<br>**Further Readings:** Web server password hacking , Session hijacking. | | |
| **UNIT 6** | **Hacking Web Application and Wireless Network** | **08 HOURS** |
| **Applications/Case Study:** Demonstrate on SQL inject on web application<br>**Contents:** Web application concepts, threats, hacking methodology, Web Application Security, SQL Injection tools and techniques Wireless Networks: Concept, Encryption, Threats, Methodology and Tools, Wireless security: Wifi, bluetooth etc. Hacking Mobile Platforms: Mobile platform attack vectors, Hacking Android OS, Mobile device management, Mobile Security and Guidelines and tools<br>**Self Study:** Identify different mobile application attacks and tools.<br>**Further Readings:** Packing sniffing methodology. | | |

## TEXT BOOKS

1. Ethical Hacking and Countermeasures V12, Professional Series by EC-Council.
2. Hacking: The Art of Exploitation, 2nd Edition by Jon Erickson

## REFERENCE BOOKS

1. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, 2nd Edition by Dafydd Stuttard and Marcus Pinto.
2. Gray Hat Hacking The Ethical Hackers Handbook, 3rd Edition" by Allen Harper and Shon Harris

## E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_cs13/course

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | ETHICAL HACKING AND CYBER LAWS LAB |
| | **COURSE CODE** | 2304424L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Cryptography and System Security, Cyber Security Forensic

## COURSE OBJECTIVES :

2304424L.CEO.1: Illustrate Elements of Information Security.
2304424L.CEO.2: Identify the different tools for footprinting.
2304424L.CEO.3: Identify different types of vulnerabilities and vulnerability Assessment Tools and Techniques.
2304424L.CEO.4: Identify different web servers, web applications attacks and countermeasures.
2304424L.CEO.5: Understand mobile and wireless applications to identify potential security vulnerabilities.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2304424L.CO.1: Apply different approaches to perform Footprinting through search engines, web, and network sites [L3].
2304424L.CO.2: Apply different scanning tools to identify the host, port, and services of the target system [L4].
2304424L.CO.3: Analyze the vulnerabilities in a given application using appropriate tools [L4].
2304424L.CO.4: Identify and exploit vulnerabilities in web applications that allow malicious SQL queries, to gain unauthorized access [L3].
2304424L.CO.5: Examine security vulnerabilities in mobile and wireless applications [L4].

**COURSE ABSTRACT:**

The Ethical Hacking Lab Course provides hands-on experience in identifying, exploiting, and mitigating cybersecurity vulnerabilities. Participants use real-world tools and techniques to conduct penetration testing, vulnerability assessments, and simulated attacks on networks, systems, and web applications. The course emphasizes ethical hacking principles, legal considerations, and developing skills to safeguard organizational assets from malicious threats. Through practical exercises, learners gain proficiency in offensive and defensive cybersecurity strategies, preparing them for roles in ethical hacking, network security, and incident response.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Foot printing and Reconnaissance.** | **4 HOURS** |
| Perform footprinting on the target network/system using search engines, web services, and social networking sites. | | |
| **PRACTICAL NO.02** | **Network Scanning.** | **4 HOURS** |
| 1) Perform host, port, service, and OS discovery on the target network 2) Perform scanning on the target network beyond IDS and Firewall | | |
| **PRACTICAL NO.03** | **Vulnerability Assessment.** | **4 HOURS** |
| Perform vulnerability assessment using various vulnerability assessment tools and analyze the vulnerable reports. | | |
| **PRACTICAL NO.04** | **Web Application Attacks.** | **4 HOURS** |
| 1) Sniffing: ARP poising using arpspoofing 2) Social Engineering 3) DoS or Session Hijacking . | | |
| **PRACTICAL NO.05** | **Hacking Web Servers.** | **4 HOURS** |
| 1) Perform Privilege Escalation to Gain Higher Privileges 2) Perform Web Cache Poisoning Attack | | |
| **PRACTICAL NO.06** | **Hacking Web Application.** | **4 HOURS** |
| 1) Perform SQL Injection and SQL Map 2) Perform a brute force attack for password cracking 3) Perform Cross Site Request forgery (CSRF) attack . | | |
| **PRACTICAL NO.07** | **Hacking Wireless Networks.** | **2 HOURS** |
| 1) Crack a WEP Network using Wifiphisher 2) Crack a WEP Network using Aircrack-ng | | |
| **PRACTICAL NO.08** | **Hacking Mobile Platforms.** | **2 HOURS** |
| SMS Phishing attack (SMishing) | | |

## TEXT BOOKS

1. Ethical Hacking and Countermeasures V11, Professional Series by EC-Council
2. Hacking: The Art of Exploitation, 2nd Edition by Jon Erickson

## REFERENCE BOOKS

1. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, 2nd Edition by Dafydd Stuttard and Marcus Pinto.
2. Gray Hat Hacking The Ethical Hackers Handbook, 3rd Edition" by Allen Harper and Shon Harris

## E-RESOURCES

1. https://nptel.ac.in/courses/106105217
2. https://tryhackme.com/r/hacktivities/practice

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | PROJECT MANAGEMENT |
| | **COURSE CODE** | 2304476T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** Software Engineering

**COURSE OBJECTIVES :**

2304476T.CEO.1: Explore various project management tools to track project progress.
2304476T.CEO.2: Illustrate project risks and challenges specific to software projects.
2304476T.CEO.3: Apply effective communication and collaboration strategies in teams.
2304476T.CEO.4: Evaluate project success using established metrics.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304476T.CO.1: Demonstrate a comprehensive understanding of core project management concepts [L2].
2304476T.CO.2: Apply knowledge to create detailed project plan that ensures the project goals are met [L3].
2304476T.CO.3: Apply the key knowledge areas and processes involved in project management [L3].
2304476T.CO.4: Identify key components of the risk management process and assess project risks through various project phases [L4].

**COURSE ABSTRACT:**

Project Management course for final year Computer Engineering students covers essential principles and practices. It begins with foundational concepts and the importance of project management, then explores planning and control systems, including tools like Gantt charts and work breakdown structures. Students also learn cost estimation, budgeting, and risk management processes. Additionally, the course addresses project quality management and organizational behavior, focusing on quality assurance and stakeholder engagement. Finally, it examines the corporate context, including maturity models and international project challenges. Through theory and case studies, students gain skills to effectively lead engineering projects in a dynamic environment.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **BASICS OF PROJECT MANAGEMENT** | **06 HOURS** |

**Applications/Case Study:** EcoBuild Construction Projects.
**Contents:** Introduction, SMART Project, Knowledge Areas and Processes, Project Manager responsibilities, Phases of Project Management Life Cycle, Project environments, Impact of Delays in Project Completions.
**Self Study:** Monitoring and Controlling (Life cycle Phase).
**Further Readings:** Agile methodologies.

| | | |
|---|---|---|
| **UNIT 2** | **SYSTEMS AND PROCEDURES FOR PLANNING AND CONTROL** | **06 HOURS** |

**Applications/Case Study:** GreenVille Urban Development Project.
**Contents:** Project: Types, Master Plan, Charter, Organization and Responsibilities. Networks Diagrams, The Critical Path, Gantt Charts and Calendar Schedules, CPM, PERT (Project Management Tools: Gantt Project, OpenProj).
**Self Study:**Work Breakdown Structure (WBS).
**Further Readings:**Asana ((Project Management Tool).

| | | |
|---|---|---|
| **UNIT 3** | **COST ESTIMATING,BUDGETING AND RISK MANAGEMENT** | **06 HOURS** |

**Applications/Case Study:** Skyline Residential Complex.
**Contents:** Cost Estimating and Cost Escalation: Process, Elements of Budgets and Estimates. Risk Management: process, Phases, Assessment, Response Planning, Tracking and Response.
**Self Study:** SWOT Analysis (Risk Management Phase).
**Further Readings:**e-Builder (Cost Estimation tool).

| UNIT 4 | PROJECT QUALITY MANAGEMENT AND ORGANIZATION BEHAVIOR | 06 HOURS |
|---|---|---|

**Applications/Case Study:** TechNova Software Development Project.
**Contents:**Concept of Quality, Processes of Project Quality Management, Techniques for Quality Assurance during System Development, Stakeholders, Managing Participation, Teamwork and Conflict.
**Self Study:** Quality Planning ( Quality Management) .
**Further Readings:**Trello ( web-based project management tool).

| UNIT 5 | CORPORATE FRAMEWORK | 06 HOURS |
|---|---|---|

**Applications/Case Study:** GlobalTech Innovations.
**Contents:** Project Management Maturity and Maturity Models, Knowledge and Time Management, International Projects and associated problems, Entrepreneurs and Startup.
**Self Study:** CMMI (Maturity Model). .
**Further Readings:** Maturity Models in Agile Environments. .

## TEXT BOOKS


1. John M. Nicholas and Herman Steyn *Project Management for Business, Engineering, and Technology*. 7th Edition 3, ELSEVIER ISBN: 978-0-7506-8399-9.
2. George Ellis *Project Management in Product Development*. 7th Copyright c 2016 Elsevier Inc, ISBN: 978-0-12-802322-8.


## REFERENCE BOOKS


1. Russ J. Martinelli, Dragan Z. Milosevic. *Project Management Toolbox*. 13th Wiley Copyright 2018, ISBN 978-1-118-97312-7.
2. Kalpesh Ashar. *Project Management Essentials You Always Wanted To Know*. vibrant publishers.
3. Christine Petersen. *The Practical guide to Project Management*. Edition 1 ISBN 978-87-403-0524-1.
4. John M. Preston. *Beginning Project Management* .
5. Russell W. Darnall, John M. Preston. *Project Management from Simple to Complex*. The Open University of Hong Kong .


## E-R ESOURCES

1. https://onlinecourses.nptel.ac.in/noc24_mg01/preview.
2. https://www.coursera.org/specializations/project-management

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Major Project - III |
| | **COURSE CODE** | 2304491L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304491.CEO.1: To understand how to carry out performance evaluation and comparative analysis in appropriate form.
2304491.CEO.2: To know about standard industry practices.
2304491.CEO.3: To become familiar with the steps involved in identifying and selecting a good platform to present the work done.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304491.CO.1: Make use of standard industry practices [L3].
2304491.CO.2: Interpret the findings and compare them with the results in the literature [L5].
2304491.CO.3: Identify weaknesses and limitations in the findings and propose improvements [L3].
2304491.CO.4: Function as a team and communicate the work done by adhering to the norms of professional ethics [L4].

## COURSE ABSTRACT:

The project is most important part of undergraduate curriculum and enables students to develop an alytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Major Project - I, Major Project - II and Major Project - III. After successful completion of Major Project - II (Sem VI), next step is Major Project - III (Sem VII). The goal of this phase of the project is to draw Inferences and Detail Analysis/Final Testing/Re-development/etc. Showcasing the work - Technical documentation in Conferences/Journal/Patent/Product/Working model.

## GUIDELINES

1. Project group students of Sem VI would be continued in this semester VII.
2. The group members may be from different programs to support the interdisciplinary functioning.
3. Projects should preferably have a national/international, industry/academic/research collaboration.
4. Students should do extended implementation of their project in consultation with their advisor.
5. For extended implementation, objectives of Sem V and Sem VI should have been already achieved.
6. Every project should follow at least one standard industry practice while implementing. For example, below are some of the standard industry practices followed by Electrical engineers:
   (a) If writing a Matlab code, follow **MathWorks Advisory Board (MAB)** Guidelines
   **(b)** For embedded c coding, **Motor Industry Software Reliability Association (MISRA)** standards can be used
   (c) If antenna is manufactured, then get **EMI/EMC** testing certificate from National Accreditation Board for Testing and Calibration Laboratories.
7. Performance evaluation and Comparative analysis of results should be carried out and presented in appropriate form.
8. Carry out detail analysis to improve performance w.r.t Final Testing/Re-development/etc.
9. Showcase the work in Conferences/Journal/Patent/Product/Working model.

**Note:** *For guideline 6, every school should identify standard industry practices and try to incorporate in the projects.*

## ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Project Review I (Internal): (10 Marks)
2. Activity (Standard industry practices): (5 Marks)
3. Project Review II (External): (10 Marks)
4. Project Report: (5 Marks)
5. Every project group should publish paper in National conference / International conference / Participate in technical project competition (with achievement) / File a patent/etc.: (5 Marks)
6. Project: Final Presentation and Demonstration (External) (40 Marks)

**Note:**

- Report should be prepared in LaTeX.
- External examiner for Review 2 and Final Demo should be allocated same group.
- Report will be jointly evaluated by External examiner and Internal examiner.

## REFERENCES


1. Eng-Choon Leong et al (2015). Guide To Research Projects For Engineering Students. CRC press, Apple Academic Press Inc. ISBN: 9781482238778, 9781482238778.
2. Michelle Reid (2018). Report Writing (Pocket Study Skills). Second Edition, Macmillan Education.
3. Leslie Lamport (2011). A Document Preparation System LaTeX: User's Guide and Reference Manual. Pearson.


## E-RESOURCES

1. IEEE Author Center
2. Intellectual Property India - Indian Patent Office
3. FlowingData
4. Design and Analysis of Experiments

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Research Methodology |
| | **COURSE CODE** | 2304492T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304492.CEO.1: To enable defining and formulating research approaches towards obtaining solutions to practical problems.

2304492.CEO.2: To facilitate development of scientific oral and written communication skills.

2304492.CEO.3: To comprehend the concepts behind adhering to scientific ethics and values.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304492.CO.1: Apply the key concepts of research methodology to provide real world solutions [L3].

2304492.CO.2: Analyze the research problems and results to evaluate the methodologies, identify limitations, and draw conclusions [L4].

2304492.CO.3: Apply scientific writing skills for preparing dissertation, research articles and research proposals [L3].

2304492.CO.4: Evaluate the ethical implications of the use of artificial intelligence tools in research, focusing on issues such as data privacy, algorithmic bias, transparency, accountability, and responsible use of AI to ensure fairness and integrity in research results [L5].

**COURSE ABSTRACT:**

Research methodology is a structured and scientific approach used to collect, analyze, and interpret quantitative or qualitative data to answer research questions or test hypotheses. A research methodology is like a plan for carrying out research and helps keep researchers on track by limiting the scope of the research. Several aspects must be considered before selecting an appropriate research methodology, such as research limitations and ethical concerns that may affect your research

A research methodology describes the techniques and procedures used to identify and analyze information regarding a specific research topic. It is a process by which researchers design their study so that they can achieve their objectives using the selected research instruments. It includes all the important aspects of research, including research design, data collection methods, data analysis methods, and the overall framework within which the research is conducted. While these points can help you understand what is research methodology, you also need to know why it is important to pick the right methodology.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Research methodology** | **6 HOURS** |

**Contents:** Meaning of research, Types of research, Research process, Problem definition, Objectives of research, Research questions, Research design, Approaches to research, Quantitative vs. qualitative approach, Understanding theory, Building and validating theoretical models, Exploratory vs. confirmatory research, Experimental vs theoretical Research, Importance of reasoning in research.

| | | |
|---|---|---|
| **UNIT 2** | **Problem formulation** | **8 HOURS** |

**Contents:** Problem formulation, Conducting literature review, Referencing, Information sources, Information retrieval, Role of libraries in information retrieval, Tools for identifying literatures, Indexing and abstracting services, Citation indexes.

| | | |
|---|---|---|
| **UNIT 3** | **Result Analysis** | **6 HOURS** |

**Contents:** Experimental research, Cause effect relationship, Development of hypothesis, Measurement systems analysis, Error propagation, Validity of experiments , Statistical design of experiments , Field experiments, Data/Variable types & classification, Data collection, Numerical and graphical data analysis, Sampling, Observation, Surveys, Inferential statistics and interpretation of result.

| | | |
|---|---|---|
| **UNIT 4** | **Scientiftc Writing** | **4 HOURS** |

**Contents:** Preparation of dissertation, research papers and proposals, Tables and illustrations, Guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript, References, citation, and listing system of documents. Ethics of Research, Scientific Misconduct, Forms of Scientific Misconduct. Plagiarism, Unscientific practices in thesis work, IPR: To give an idea about IPR, registration, patents,copyrights, and its enforcement.

| | | |
|---|---|---|
| **UNIT 5** | **Artiftcial Intelligence Tools & Ethics in Research** | **4 HOURS** |

**Contents:** Role of AI in modern research practices, AI Tools for Data Collection and Analysis, Ethical Considerations in AI for Research, AI, Research Integrity, and Bias, Responsible Use of AI in Research, Future Trends in AI and Research Ethics, NITI Aayog National Strategy for Artificial Intelligence.

## TEXT BOOKS


1. C. R. Kothari (2023). Research Methodology. New Age International Publishers, Fifth Edition, ISBN: 978-9389802559.
2. Ranjit Kumar (2024). Research Methodology: A Step by Step Guide for Beginners. SAGE Publications, Fourth Edition, ISBN: 978-9351501336.


## REFERENCE BOOKS


1. Shanti Bhushan Mishra, Shashi Alok (2017). Handbook of Research Methodology. Educreation, First Edition, ISBN: 978-1-5457-0340-3.
2. Chandra Vinod, Hareendran Anand (2017). Research Methodology. Pearson Education, First Edition, ISBN:978-9352863518.


## E-RESOURCES

1. National Strategy for Artificial Intelligence
2. AI Standards & Policies

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Summer Internship (Technical) |
| | **COURSE CODE** | 2304496L |
| | **COURSE CREDITS** | 4 |
| **RELEASE DATE :** | **REVISION NO** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | NIL | 150 | 150 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2304496L.CEO.1: To enhance technical skills and self-directed learning.

2304496L.CEO.2: To develop adaptability and resilience in a multicultural or professional environment. product/system/software.

2304496L.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2304496L.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2304496L.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2304496L.CO.1: Analyse the organizational structure and workflow of a professional setup to identify opportunities for optimization and innovation [L4].

2304496L.CO.2: Design innovative products, systems, or software by integrating interdisciplinary knowledge and addressing real-world challenges [L5].

2304496L.CO.3: Collaborate effectively within multidisciplinary teams to achieve project objectives, demonstrating strategic decision-making and problem-solving skills [L4].

2304496L.CO.4: Evaluate industry-relevant practices through hands-on experience, enhancing professional competence and adaptability [L4].

2304496L.CO.5: Formulate comprehensive and innovative engineering problem statements by synthesizing technical knowledge and industry insights [L4].

2304496L.CO.6: Analyze project feasibility using cost estimation, budgeting, and financial metrics (ROI, payback, NPV) to support informed decisions during the internship [L5].

## INTRODUCTION

The Student Internship Program (SIP) aims to empower final-year entrants B.Tech. students by providing them with valuable opportunities to engage with industry and academic centers of excellence. Through SIP, students gain comprehensive practical experience that bridges the gap between classroom learning and real-world application.

The program is designed to cultivate professionalism, enhance networking capabilities, and strengthen academic and professional skills, ensuring students are well-prepared for the demands of today's competitive global market. By participating in internships, students can apply their academic knowledge in professional settings, fostering a deeper understanding of their field and equipping them with the expertise needed to excel in their future careers.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the final year of the B.Tech. program, to be undertaken during the summer break after Semester VI. This program aims to provide opportunities for skill enhancement through industrial internship or research internship exposure. The internship focuses on helping students identify and engage with relevant MNC, medium scale enterprise, or small-scale industries, or research organization to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

- **Duration:** : 4 to 8 weeks (minimum of 160 hours).
- **Timeframe:** Conducted during June-July of each academic year.
- **Nature of Internship:**

1. Industrial internship with MNC or medium-scale industries.
2. Research internship in the CSIR lab or DRDO / IIT / IISc / NCL / NEERI etc

- **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.
- **Mentorship:** Each third-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development.

**Student Development Focus :**

Before selecting an internship option, second-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance inidentifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

---

**1. Continuous Assessment (CA): Biweekly Progress Reports and interaction with faculty mentor (40%):**

Students must submit at least two progress reports during the internship/training period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them

**2. Detailed Project Report with Learning Outcomes (30%)**

Upon completion of the internship, students are required to submit a comprehensive minimum of 30 to 40 pages' internship/project report. The report must include:

1. Overview of the Industry/Research Institute
2. Skills and knowledge acquired (technical).
3. Specific challenges addressed
4. Personal and professional growth reflections
5. Clearly stated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certiftcate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev. (NEP)) |
| FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | CYBER SECURITY |
| | COURSE CODE | 2304412T |
| | COURSE CREDITS | 4 |
| RELEASE DATE : | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 4 | NIL | 60 | NIL | 90 | NIL | NIL | 150 |

**PREREQUISITE :** COMPUTER NETWORK

**COURSE OBJECTIVES :**

2304412T.CEO.1: Introduce foundational cybersecurity concepts including threats, vulnerabilities, encryption, and ethical hacking methodologies.
2304412T.CEO.2: Equip learners with practical knowledge of securing network infrastructure and endpoints
2304412T.CEO.3: Enable students to apply AI and ML techniques for threat detection and defense
2304412T.CEO.4: Integrate computer vision approaches for malware and anomaly detection.
2304412T.CEO.5: Understand and implement IoT security and communication protocols.
2304412T.CEO.6: Explore and apply cloud security best practices in real-world contexts.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304412T.CO.1: Explain core cyber security principles and apply incident response strategies. [L3].
2304412T.CO.2: Demonstrate hands-on ability to secure networks and systems [L3].
2304412T.CO.3: Apply AI/ML models for threat detection and defense against adversarial attacks [L3].
2304412T.CO.4: Implement computer vision for malware detection and biometric access control [L3].
2304412T.CO.5: Design and secure IoT infrastructures addressing vulnerabilities and privacy [L3].
2304412T.CO.6: Apply cloud security tools and practices to prevent misconfigurations and data leaks [L3].

**COURSE ABSTRACT:**

This course offers a deep dive into modern cybersecurity, covering foundational principles, network defenses, AI-driven threat detection, computer vision security, IoT protection, and cloud security. Through real-world case studies and hands-on labs, students learn to analyze attacks, secure systems, and apply cutting-edge tools and techniques. Emphasis is placed on practical skills in threat modeling, adversarial AI, steganography, and secure cloud configurations. By the end of the course, learners will be equipped to build and manage resilient, intelligent, and secure digital environments.

**THEORY COURSE CONTENTS**

| UNIT 1 | FOUNDATIONS OF CYBERSECURITY | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Dissection of the SolarWinds supply chain attack — mapping attack vectors and response strategies.

**Contents:Introduction to Cybersecurity:** Basic concepts, threats, vulnerabilities, and security principles. **Data Security:** Data encryption, access control and data loss prevention.**Application Security:** Secure development practices, input validation.**Ethical Hacking:** Understanding how attackers think and testing security measures. **Incident Response:** Procedures for handling security breaches. **Lab:** Network analysis using Wireshark and threat modeling with STRIDE

**Self Study:** History of major cyber attacks (e.g., Stuxnet, Equifax breach) ,CIA Triad

**Further Readings:** Advanced Persistent Threats (APT), Security Information and Event Management (SIEM)

| UNIT 2 | NETWORK AND SYSTEM SECURITY | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Analysis of the Dyn DNS DDoS attack via IoT devices — securing endpoints and networks.

**Contents:** Firewalls, IDS/IPS, Zero Trust Architecture. Common attacks: DDoS, Man-in-the-Middle (MITM), Endpoint security and patch management

**Lab:** Simulate DDoS using LOIC, firewall configuration

**Self Study:**Packet inspection and protocol layers (OSI model), Network segmentation and VLANs

**Further Readings:**Intrusion Detection Using Deep Learning,Software-Defined Perimeter (SDP).

| UNIT 3 | INTELLIGENT SECURITY SYSTEMS: AI TECHNIQUES | 10 HOURS |
|---|---|---|

**Applications/Case Study:**Attacking an image classifier with adversarial inputs — evasion and mitigation techniques.

**Contents:AI and ML Fundamentals:** Understanding machine learning algorithms, neural networks, and other AI techniques. **AI-Driven Threat Detection:** Using AI to identify and prevent malicious activity. **Anomaly Detection**: Detecting unusual patterns in network traffic or system behaviour.**Adversarial AI:** Understanding how AI models can be manipulated and how to defend against adversarial attacks.**AI-Powered Security Solutions:** Exploring various AI-based security tools and technologies. **Lab:** Perform an FGSM adversarial attack on a CNN model using PyTorch or TensorFlow

**Self Study:** Basics of supervised vs unsupervised learning, Confusion matrix and ROC curves for model evaluation, Adversarial example generation techniques

**Further Readings:**Explainable AI (XAI) for Cybersecurity, Transfer Learning in Threat Detection.

| UNIT 4 | SECURING SYSTEMS WITH COMPUTER VISION | 10 HOURS |
|---|---|---|

**Applications/Case Study:**Multi-Layered Threat Detection and Access Control Using Computer Vision Techniques.

**Contents: Computer Vision Fundamentals:**Understanding image processing, object recognition, and machine vision techniques. **Malware Detection in Images:** Using computer vision to identify malware embedded in images, especially in phishing emails. **Image-Based Anomaly Detection:** Using computer vision to detect unusual patterns in visual data, like network traffic or video footage. **Facial Recognition for Access Control:** Implementing facial recognition systems for secure access to physical and digital environments.

**Lab:** Malware Detection in Images (Steganography Analysis)

**Self Study:** Image classification vs object detection, Common CV architectures (e.g., CNNs, YOLO, ResNet), Introduction to steganography and digital watermarking

**Further Readings:**Deepfake Detection Techniques, Vision-Based Behavioral Biometrics, 3D Facial Recognition and Spoofing Countermeasures

| UNIT 5 | BUILDING RESILIENT IOT SYSTEMS | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Exploiting the Mirai botnet — understanding how unsecured IoT devices are hijacked.

**Contents: IoT Security Fundamentals:** Understanding the vulnerabilities of IoT devices and networks. **Securing IoT Devices:** Implementing security measures for IoT devices, including authentication, encryption, and intrusion detection.**IoT Network Security:** Securing the communication channels and protocols used by IoT devices. **Data Privacy in IoT:** Addressing privacy concerns related to the collection, storage, and use of data from IoT devices. **IoT Device Security Manage- ment:** Managing the security of a large number of IoT devices.

**Lab:** Firmware extraction and basic analysis using Binwalk; scan IoT devices via Shodan

**Self Study:** IoT protocols: MQTT, CoAP. Common IoT OS platforms: RIOT, Contiki.Device hardening and secure boot

**Further Readings:** Secure Boot and Trusted Execution Environment (TEE),Blockchain for IoT Security and Authentication, AI-Powered Intrusion Detection for IoT Networks.

| UNIT 6 | CLOUD AND QUANTUM SECURITY | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Case of Uber's S3 bucket data leak — how misconfigurations led to massive data exposure.

**Contents:** Introduction to Cloud Computing, Types of Cloud Computing : Public, Private and Hybrid, Cloud service models (IaaS, PaaS, SaaS), Identity Access Management (IAM), encryption, audit logs, **Cloud security tools:** AWS Inspector, GCP Security Command Center.**Quantum Computing and Security:**Overview of Quantum Computing fundamentals,Threats to classical encryption by quantum algorithms (e.g., Shor's algorithm),Post-quantum cryptography and future-safe cryptographic standards.

**Lab:** Implement RBAC and encryption in AWS free tier **Self Study:**Cloud misconfiguration risks and prevention, IAM policies and RBAC vs ABAC. Cloud-native threat modeling

**Further Readings:** Cloud Security Posture Management (CSPM).

## TEXT BOOKS


1. William Stallings, Lawrie Brown (2018). *Computer Security: Principles and Practice.* 4th Edition, Pearson. ISBN: 9780134794105.
2. Mark Stamp (2020). Information Security: *Principles and Practice*. 3rd Edition, Wiley. ISBN: 9781119570485.
3. Al-Sakib Khan Pathan (2016). *Security of Internet of Things: Challenges and Solutions*. CRC Press. ISBN: 9781138031784.
4. Tim Mather, Subra Kumaraswamy, Shahed Latif (2009). *Cloud Security and Privacy*. O'Reilly Media. ISBN: 9780596802769.


## REFERENCE BOOKS


1. Clarence Chio, David Freeman (2018). *Machine Learning and Security: Protecting Systems with Data and Algorithms*. O'Reilly Media. ISBN: 9781491979907.
2. 
3. William Stallings (2013). *Network Security Essentials: Applications and Standards*. 4th Edition, Pearson. ISBN: 9780133370430.
4. Mohamed Elgendy (2020). *Deep Learning for Vision Systems. Manning Publications*. ISBN: 9781617296192.
5. Bruce Schneier (2015). *Applied Cryptography: Protocols, Algorithms, and Source Code in C*. 20th Anniversary Edition, Wiley. ISBN: 9781119096725.


## E-R ESOURCES

1. OWASP (Open Web Application Security Project) – https://owasp.org
2. Shodan (IoT Device Search Engine) – https://www.shodan.io
3. Wireshark Official Documentation – https://www.wireshark.org/docs/
4. AWS Security Documentation – https://docs.aws.amazon.com/security

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING** | **COURSE NAME** | Semester Long Internship Program (SLIP) |
| | **COURSE CODE** | 2304497L |
| | **COURSE CREDITS** | 8 |
| **RELEASE DATE :** | **REVISION NO** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | 150 | 150 | 300 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2304497L.CEO.1: To get acquainted with the organization structure
2304497L.CEO.2: To gain learning and living experience
2304497L.CEO.3: To develop appropriate workplace attitudes
2304497L.CEO.4: To get Hands-on experience in the related field to relate and reinforce what has been taught at the university
2304497L.CEO.5: To formulate the problem statement

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2304497L.CO.1: Analyze real-world engineering problems and propose effective solutions using domain-specific knowledge [L4].

2304497L.CO.2: Evaluate suitable problem-solving methodologies and modern tools to address practical engineering challenges [L5].

2304497L.CO.3: Demonstrate the ability to work effectively in cross-cultural and multidisciplinary teams within a professional environment [L4].

2304497L.CO.4: Develop and demonstrate teamwork, leadership, and communication skills required for collaborative and individual tasks [L4].

2304497L.CO.5: Apply ethical principles and commit to professional responsibilities and norms in engineering practice [L3].

2304497L.CO.6: Demonstrate awareness of the need for, and engage in, independent and lifelong learning to remain relevant in technological and professional domains [L4].

## INTRODUCTION

The Final-Year Semester-long internship program is structured to provide B.Tech. students with extended, in-depth exposure to real-world industrial environments and academic centers of excellence. Spanning 4 to 6 months, this internship serves as a vital bridge between academic coursework and professional practice, enabling students to apply theoretical knowledge to complex, practical challenges.

Through sustained engagement in industry settings, students develop critical technical competencies, professional ethics, and workplace readiness. The program nurtures a sense of responsibility, fosters independent thinking, and sharpens problem-solving and project management skills. It also enhances students' ability to collaborate in multidisciplinary and multicultural teams, preparing them for dynamic, global work environments.

By immersing themselves in live projects, students gain hands-on experience, expand their professional network, and build the confidence and expertise necessary to transition seamlessly into their careers or pursue higher academic goals.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students the final year of the B.Tech. program, to be undertaken after Semester VII. This program aims to provide opportunities for skill enhancement through industrial internship or research internship exposure. The internship focuses on helping students identify and engage with relevant MNC, medium scale enterprise, or small-scale industries, or research organization to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

- **Duration:** 16 to 24 weeks.
- **Timeframe:** Conducted during Jan-June of each academic year.
- **Nature of Internship:**

1. Industrial internship with MNC or medium-scale industries.
2. Research internship in the CSIR lab or DRDO / IIT / IISc / NCL / NEERI etc

- **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.
- **Mentorship:** Each final-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development.

**Student Development Focus :**

Before selecting an internship option, final-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance inidentifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

---

**1. Continuous Assessment (CA): (Biweekly Progress Reports, Faculty Mentor Interaction Mid-Term Review) (50%)**

Students must submit biweekly progress reports during the internship period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them
- Regular interaction with the assigned faculty mentor is expected for guidance and monitoring. **A mid-term review will be conducted between the 8th and 12th week of the internship**. This review will evaluate the student's progress, alignment with learning objectives, and address any critical feedback for improvement. It will be considered as part of the CA component.

**2. Detailed Project Report with Learning Outcomes (20%)**

Upon completion of the internship, students are required to submit a comprehensive internship/project report (minimum 40 to 60 pages) which should include:

1. Overview of the Industry/Research Institute
2. Skills and knowledge acquired (technical).
3. Specific challenges addressed,
4. Reflections on personal and professional growth
5. Clearly articulated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certiftcate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2025 - 2026 (Rev. (NEP)) |
| **FINAL YEAR BACHELOR TECHNOLOGY** | **COURSE NAME** | Capstone Portfolio |
| | **COURSE CODE** | 2304493L |
| | **COURSE CREDITS** | 08 |
| **RELEASE DATE :** | **REVISION NO.** | NEP 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 16 | NIL | NIL | NIL | 150 | 150 | 300 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304493.CEO.1: Identify solutions at different scales, ensuring sustainability within diverse engineering contexts.

2304493.CEO.2: Develop a capstone project or research internship problem adhering to standard engineering practices with precision and accuracy.

2304493.CEO.3: Organize artifacts and results through teamwork and effective communication under project or research internship constraints.

2304493.CEO.4: Synthesize findings into a reflective report that communicates results with professional ethics.

2304493.CEO.5: Create a professional portfolio showcasing achievements and growth aligned with engineering standards.

2304493.CEO.6: Justify progressive growth in a portfolio, highlighting contributions to sustainability and teamwork.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304493.CO.1: To Analyze capstone research work and find sustainable solutions in diverse engineering contexts. [L4]

2304493.CO.2: To Design a capstone research work using methodologies aligned with engineering standards. [L4]

2304493.CO.3: To Compile artifacts and outcomes collaboratively within project or research internship constraints. [L3]

2304493.CO.4: To Evaluate findings and prepare a reflective report adhering to ethical standards. [L5]

2304493.CO.5: To Create a digital personal portfolio in engineering practices. [L4]

2304493.CO.6: To present portfolio and graduation book reflecting contributions to sustainability and teamwork. [L4]

**COURSE ABSTRACT:**

The capstone project is an individual, self-identified endeavor focusing on technical or non-technical challenges. It emphasizes risk-taking, high productivity, strong design research, and the creation of advanced solutions through innovative methodologies. Students are empowered to choose their projects, formulate solutions, negotiate deliverables, and work independently, culminating in a digital presentation. The capstone experience fosters critical thinking, problem-solving, and adaptability, aligning with professional engineering practices and research standards. A research internship complements this by exposing students to real-world applications of their skills, strengthening their ability to address complex challenges, and enhancing their professional preparedness. Together, the capstone project and internship provide a comprehensive platform for students to demonstrate their technical acumen and research capabilities. The digital portfolio and graduation book integrate these experiences into a cohesive collection of work that reflects the evolution of skills and ideas. Combining written and visual content, it showcases critical thinking, design processes, and final artifacts. Students craft a professional voice through reflective articles, personal design philosophies, and enhanced online profiles, such as on LinkedIn. This structured portfolio serves as a powerful tool to articulate achievements and establish a professional identity.

Capstone portfolio is divided into two section a) Capstone Research work b) Digital Portfolio

**CAPSTONE RESEARCH WORK :**

Individual student can choose the topic from one of the below capstones to carry out the work during the entire semester

1. Technical Capstone
    - Industry identified problem
    - Institute identified problem
    - Urban city identified problems
    - Rural Development
    - Environmental related problems
    - Student Conceived problems
    - Satisfactory solution to Open ended problems
    - Innovative Design stemming from Student/Faculty
    - Product Development
    - App/ Software Development
    - Multidisciplinary approach to existing problem
    - Modeling/Optimization/Analysis study
2. Writing Intensive Capstone
    - Design
    - Literature Survey
    - Commercial Survey
    - Social media Survey
    - Idea/ Design Philosophy
    - Research Methodology
    - Consultancy Project work
    - Collaborative Project work
    - Laboratory/Digital classroom
    - Manage/lead any Event/activity
3. TechFrontier Capstone
    - State of art
    - Challenges and Prospect of Technology (Engineering) Education in Primary and Secondary Schools
    - Market Statistics

**DIGITAL PORTFOLIO :**

Individual student should create there own digital portfolio by using the standard professional platforms/blogs based on the record during their entire Under Graduate program. Digital portfolio should be professional, amalgamation of technical, written, graphical/Visual content and Verbal culmination of the skills and knowledge that students have developed over their under graduate program.

1. Process Portfolio
2. Show case Portfolio
3. Hybrid Portfolio

**GRADUATION BOOK :**

A graduation book is a comprehensive document showcasing students' achievements, projects, and reflections during their academic journey. It serves as a portfolio and a keepsake, reflecting their growth and accomplishments.

It should basically covered following content or c vtext

1. Personal Portfolio: Focused on an individual student's projects, awards, and career goals.
2. Class/Batch Book: Highlights collective achievements, group projects, and memorable moments of a graduating class.
3. Thematic Graduation Book: Centers on a specific theme, such as innovation, sustainability, or community impact, showcasing relevant work.

**GUIDELINES :**

1. Capstone Research Project: Each student is required to individually work on their capstone project throughout the semester, ensuring sustained focus and progress.
2. Title Approval: Students must propose a title for their capstone project, subject to approval by the Supervisor and School Dean.
3. Scope of Work: The approved topic must be pursued with extensive research, accurate data, the necessary evidence, and measurable results.
4. Digital Portfolio: Students must independently create a digital portfolio to showcase their capstone work and overall growth.
5. Graduation book: Each student must authored a detailed graduation book documenting the capstone project, following plagiarism guidelines.
6. Alignment with Capstone Work: The research internship should complement the capstone project, reinforcing technical expertise, research methods, and professional skills.
7. Supervisor and Department Review: Capstone work and digital portfolios must be evaluated by the Supervisor and another faculty member from the department to ensure adherence to guidelines and quality standards.
8. Exemplary Performance Review: Exceptional capstone work may qualify for a secondary review, termed as "Capstone Work Review 2," to evaluate the student's competency. Supervisors may request a concise report if the work is deemed remarkable. Examples of exemplary achievements include:
    - Published articles in Scopus-indexed journals.
    - Approved research proposals.
    - Wins in design competitions, technical fests, or workshops.
    - Wins in state, national, or international events (technical/non-technical).
    - Valid scores in competitive exams (e.g., GATE, CAT, GRE, TOEFL, IELTS).
9. Capstone and Portfolio Assessment: Both the capstone project and digital portfolio will undergo a formal review by the supervisor and department faculty.
10. Jury Examination: The final examination will be conducted in the presence of a jury panel to evaluate the student's overall performance and competency.
11. Initiative and Ownership: Students are expected to take ownership of their work, from choosing the title to completing the capstone project and research internship independently.
12. Quality and Ethics: Work submitted must meet academic standards, demonstrating quality, originality, and ethical research practices.

## ASSESSMENT and EVALUATION :

The Jury will be appointed to monitor the progress and continuous evaluation of each project. One of the members will be the Capstone Research work internship supervisor. The evaluation shall be performed jointly by the supervisor and the jury members.

1. Continuous assessment (150 marks)
    - Capstone Research work Review 1 (75 Marks)
    - Capstone Research work Review 2 (75 Marks)
2. Final Presentation and Demonstration (150 Marks)
    - Digital Portfolio and Graduation Book (75 Marks)
    - Capstone Research work Final demonstration (75 Marks)

## REFERENCES


1. https://design.berkeley.edu/ Berkeley M.Des. University of California, U.S. . ://design.gatech.edu/ Georgia Institute of Technology, College of Design Atlanta, U.S.
2. https://www.apus.edu/ American Public University
3. https://msu.edu/ Michigan State University's US
4. https://www.cranfield.ac.uk Cranfield University, Shrivenham Swindon UK
5. https://my.bulbapp.com/personalized-learning/assessment-infographic-blog/
6. https://edtechjeffco.weebly.com
7. https://www.invisionapp.com/inside-design/10-portfolio-websites-to-show-off-your-design-work/


## E-R ESOURCES

1. https://www.canva.com/learn/design-digital-portfolio
2. https://www.adobe.com/in/express/create/online-portfolio
3. https://www.masterclass.com/articles/how-to-make-a-digital-portfolio .
4. https://issuu.com/solutions/design/portfolio

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| COMPUTER ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev. (NEP) |
| FINAL YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING | COURSE NAME | Industry Practicum |
| | COURSE CODE | 2304499L |
| | COURSE CREDITS | 8 |
| RELEASE DATE : | REVISION NO | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | 150 | 150 | 300 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2304499L.CEO.1: To get acquainted with the organization structure
2304499L.CEO.2: To gain learning and living experience
2304499L.CEO.3: To develop appropriate workplace attitudes
2304499L.CEO.4: To get Hands-on experience in the related field to relate and reinforce what has been taught at the university
2304499L.CEO.5: To formulate the problem statement

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2304499L.CO.1: Analyze real-world engineering problems and propose effective solutions using domain-specific knowledge [L4].

2304499L.CO.2: Evaluate suitable problem-solving methodologies and modern tools to address practical engineering challenges [L5].

2304499L.CO.3: Demonstrate the ability to work effectively in cross-cultural and multidisciplinary teams within a professional environment [L4].

2304499L.CO.4: Develop and demonstrate teamwork, leadership, and communication skills required for collaborative and individual tasks [L4].

2304499L.CO.5: Apply ethical principles and commit to professional responsibilities and norms in engineering practice [L3].

2304499L.CO.6: Demonstrate awareness of the need for, and engage in, independent and lifelong learning to remain relevant in technological and professional domains [L4].

## INTRODUCTION

The Final-Year Semester-long internship program is structured to provide B.Tech. students with extended, in-depth exposure to real-world industrial environments and academic centers of excellence. Spanning 4 to 6 months, this internship serves as a vital bridge between academic coursework and professional practice, enabling students to apply theoretical knowledge to complex, practical challenges.

Through sustained engagement in industry settings, students develop critical technical competencies, professional ethics, and workplace readiness. The program nurtures a sense of responsibility, fosters independent thinking, and sharpens problem-solving and project management skills. It also enhances students' ability to collaborate in multidisciplinary and multicultural teams, preparing them for dynamic, global work environments.

By immersing themselves in live projects, students gain hands-on experience, expand their professional network, and build the confidence and expertise necessary to transition seamlessly into their careers or pursue higher academic goals.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the final year of the B.Tech. program, to be undertaken after Semester VI. This program aims to provide opportunities for skill enhancement through industrial internship or research internship exposure. The internship focuses on helping students identify and engage with relevant MNC, medium scale enterprise, or small-scale industries, or research organization to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

- **Duration:** 16 to 24 weeks.
- **Timeframe:** Conducted during August-December of each academic year.
- **Nature of Internship:**

1. Industrial internship with MNC or medium-scale industries.
2. Research internship in the CSIR lab or DRDO / IIT / IISc / NCL / NEERI etc

- **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.
- **Mentorship:** Each final-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development.

**Student Development Focus :**

Before selecting an internship option, final-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance inidentifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

---

**1. Continuous Assessment (CA): (Biweekly Progress Reports, Faculty Mentor Interaction Mid-Term Review) (50%)**

Students must submit biweekly progress reports during the internship period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them
- Regular interaction with the assigned faculty mentor is expected for guidance and monitoring. **A mid-term review will be conducted between the 8th and 12th week of the internship**. This review will evaluate the student's progress, alignment with learning objectives, and address any critical feedback for improvement. It will be considered as part of the CA component.

**2. Detailed Project Report with Learning Outcomes (20%)**

Upon completion of the internship, students are required to submit a comprehensive internship/project report (minimum 40 to 60 pages) which should include:

1. Overview of the Industry/Research Institute
2. Skills and knowledge acquired (technical).
3. Specific challenges addressed,
4. Reflections on personal and professional growth
5. Clearly articulated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certiftcate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

# Outline of Question paper

The question paper format with common instructions shall be provided to the paper setter.

around 40 percent of each paper should be structured viz questions could be set from book work, or be of similar type and difficulty as questions used in tutorials, or consist of a number of part-questions requiring brief answers

50 per cent should be testing the ability of students to apply what is taught in the class to various real-life situations (maybe case study type of questions)

10 percent of the questions should comprise of abstract questions i.e. questions related to the subject but from topics which may or may not be included in the curriculum. It should test the general reading done by the students over and above the published course content (self-learning)

Straightforward' questions or parts of questions: these are aimed at testing principles and students' basic knowledge and understanding. The average student who has worked well should have no difficulty in obtaining 40% of the total marks for the paper from the straightforward parts. These should address the first three levels of the Blooms Taxonomy - namely remembering, understanding and applying.

More difficult' questions or parts of questions: These will require extra thought and / or understanding than 'straightforward' questions, or more specialized knowledge. These will be based on the Higher order thinking skills defined by Blooms Taxonomy viz questions based on analyzing, evaluating and creating

**Setting Questions:**

a) These guidelines relate to a 2-hour prescribed marks examination paper in which all questions must be answered. The questions do not need to carry the same marks.
b) It is assumed that 30 minutes will be available, on average, per question, leaving 30 minutes for reading the examination paper and for final checking etc.
c) Quantitative questions: A suggested guide for length of quantitative questions is that it should take the examiner (who knows what the answer should be) 15 minutes to write down his specimen answer in a form which would be acceptable for the award of maximum marks. This will ensure that the examinee has 50% thinking time to go with 50% writing and calculating time
d) Descriptive questions: For purely descriptive questions the examiner should base the question on about 20 minutes writing time for the student, i.e., about two thirds of the time available. Descriptive questions should be carefully set so that students must indicate understanding of the particular subject.
e) Multi-part questions: These have many advantages but should conform broadly to the following principles-
i) Errors in an early part should not significantly prejudice the gaining of marks for subsequent parts
ii) A mixture of 'straightforward' and 'more difficult' parts may be used to adjust overall difficulty level. If possible, the easier parts should come first.
iii) The marking schedule should be even between parts unless stated otherwise, when the marks available should be clearly indicated
f) Model answers: Clearly written and well-presented model answers (solution set) are expected from examiners and should accompany the question paper when submitted.
g) Nature of the question paper should be precise. The paper setter should design the question paper such that the questions are unambiguous, are written in simple and meaningful words, should be asked for appropriate marks and should cover the entire syllabus prescribed for the course.
h) A scheme of marking, giving distribution of marks for different points in the question shall be included in the question paper for the guidance of the examinees as well as for the examiners assessing the answer books.
i) The paper setter should specifically mention the Charts, Tables, other documents / data books etc. The use of which shall be permitted during the actual conduct of the examination. Pre-printed data sheets maybe provided as per need, to be used by students during the examinations.
j) The faculty shall not write any instructions in the question paper that will violate the examination rules.

SET A

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Reg. No:

**End Semester Examination - December 2025**

| | | | |
|---|---|---|---|
| Programme | | Date of Examination | |
| Course Code | | Semester | |
| Course Name | | Total No. of Questions | |
| Class | | Pattern | **2023 REGULAR PATTERN** |
| Time | **2 hours** | Max. Marks | |

Instructions To Candidates

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed.
3. Black figures to the right indicate full marks.

**Bloom Level(BL):** 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

| **Answer the following Questions (Answer all Question (s) and all its parts only)** | **Marks** | **CO** | **BL** |
|---|---|---|---|
| **Q1.** | **10** | **1** | **2** |
| **Q2.** | **10** | **2** | **3** |
| **Q3.** | **10** | **3** | **3** |

In the TOS, first you have to plan the distribution of 100 marks into the respective COs.

| **CO Number** | **Marks** | |
|---|---|---|
| CO 1 | | L3 |
| CO 2 | | L3 |
| CO 3 | | L3 |
| CO 4 | | L6 |
| CO 5 | | L5 |
| **Total** | | |

Table 1

In Category 2, the distribution of questions for the respective COs in a tabular form should be presented.
Prepare 6 tables ( one for each CO)

CO 5: Explain software quality standards [L2]

| Cognitive level / Knowledge Domain | L1 remember | L2 Understand | L3 Apply | L4 Analyse | L5 Evaluate | L6 Create |
|---|---|---|---|---|---|---|
| Factual | | | | | | |
| Conceptual | | | | | | |
| Procedural | | | | | | |
| Meat Cognitive | | | | | | |

LOTS ( Lower Order Thinking skills)
HOTS (Higher Order thinking Skills)

The numbers written like 1 (2), where the first number indicate the question number and the number in bracket indicating the marks for the particular question.

Category 3: Distribution of marks as per the cognitive levels

| Cognitive Level | Marks | % |
|---|---|---|
| L1 Remember | | |
| L2 Understand | | |
| L3 Apply | | |
| L4 Analyse | | |
| L5 Evaluate | | |
| L6 Create | | |

This is combined input of all the 6 tables under category 2,

In the TOS(Table of Specification), first you have to plan the distribution of marks into the respective COs.

| CO Number | Marks | |
|---|---|---|
| CO 1 | | L3 |
| CO 2 | | L3 |
| CO 3 | | L3 |
| CO 4 | | L6 |
| CO 5 | | L5 |
| **Total** | | |

Table 1

In Category 2, the distribution of questions for the respective COs in a tabular form should be presented.
Prepare 6 tables ( one for each CO)

CO 4: Create Test cases for different testing techniques using testing tools[L6]

| Cognitive level / Knowledge Domain | L1 remember | L2 Understand | L3 Apply | L4 Analyse | L5 Evaluate | L6 Create |
|---|---|---|---|---|---|---|
| Factual | | | | | | |
| Conceptual | | | | | | |
| Procedural | | | | | | |
| Meat Cognitive | | | | | | |

LOTS ( Lower Order Thinking skills)
HOTS (Higher Order thinking Skills)

The numbers written like 1(2), where the first number indicate the question number and the number in bracket indicating the marks for the particular question.

Category 3: Distribution of marks as per the cognitive levels

| Cognitive Level | Marks | % |
|---|---|---|
| L1 Remember | | |
| L2 Understand | | |
| L3 Apply | | |
| L4 Analyse | | |
| L5 Evaluate | | |
| L6 Create | | |

This is combined input of all the 6 tables under category 2

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for
# Under Graduate Program
# Bachelor of Technology in
# Information Technology

(Choice Based Credit System)

**NEP REVISION**

(Four Year Curriculum W.E.F, AY: 2026-27)

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MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

# INSTITUTE VISION

**To be a new age learning center for holistic development of students into professional engineers, to cater to the changing needs of techno-society.**

# INSTITUTE MISSION

- **To provide new-age infrastructural facilities blended with skill-based curriculum and activity-based pedagogical approaches to develop competitive engineering professionals to solve real-world problems.**
- **To prepare students for lifelong learning by transforming educational practices.**
- **To promote ethical and moral values by involving students in community services.**
- **To promote entrepreneurship and managerial skills by strengthening industry-institute interaction.**

# DEPARTMENT OF INFORMATION TECHNOLOGY

## VISION

**To develop the department into a globally recognized academic hub, cultivating students' academic and technical competencies, and equipping them to address the complexities of the real-world problems.**

## MISSION

- **Focusing on co-curricular and extra curricular activities along with curricular activities for holistic development.**
- **Enhancing the curriculum with adaptive teaching and innovative pedagogical assessment.**
- **Developing career-oriented skills such as employability, leadership, entrepreneurship, and ethical values**

# PROGRAM EDUCATIONAL OBJECTIVES(PEO's)

| PEO | PROGRAM EDUCATIONAL OBJECTIVES(PEO's) |
|---|---|
| PEO1 | Develop robust problem-solving abilities, analytical thinking, and effective communication skills in individuals. |
| PEO2 | Enhance technical expertise and leadership abilities to thrive in engineering management roles. |
| PEO3 | Professionals in the field of IT possess a thorough understanding of the ethical, societal, technological, and business contexts that influence engineering practices. |

# WASHINGTON ACCORD PROGRAM KNOWLEDGE AND ATTITUDE PROFILE (WK's)

| WK No. | WASHINGTON ACCORD PROGRAM KNOWLEDGE AND ATTITUDE PROFILE (WKs) | PO |
|---|---|---|
| WK1 | A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences. | PO1, PO2, PO6 |
| WK2 | Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline. | PO1, PO2, PO5 |
| WK3 | A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline. | PO1, PO2 |
| WK4 | Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline. | PO1, PO2 |
| WK5 | Knowledge, including efficient resource use, environmental impacts, whole-life cost,reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area. | PO3, PO6 |
| WK6 | Knowledge of engineering practice (technology) in the practice areas in the engineering discipline. | PO5 |
| WK7 | Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development. | PO6 |
| WK8 | Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues. | PO4 |
| WK9 | Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes. | PO11 |

# PROGRAM OUTCOMES (PO's)

| PO | PROGRAM OUTCOMES (PO's) | WK |
|---|---|---|
| PO1 | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. | (WK1 to WK4) |
| PO2 | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | (WK1 to WK4) |
| PO3 | **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | (WK5) |
| PO4 | **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | (WK8) |
| PO5 | **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. | (WK2 and WK6) |
| PO6 | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. | (WK1, WK5, and WK7) |
| PO7 | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. | (WK9) |
| PO8 | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | -- |
| PO9 | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | -- |
| PO10 | **Project management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. | -- |
| PO11 | **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | (WK8) |

# PROGRAM SPECIFIC OUTCOMES(PSO's)

| PSO | PROGRAM SPECIFIC OUTCOMES (PSO's) |
|---|---|
| PSO1 | To develop advanced technical skills in software development, system integration, cloud computing, data management, cybersecurity, and network administration by utilizing industry-standard tools and frameworks to design, develop, and deploy scalable solutions, preparing to tackle real-world IT challenges. |
| PSO2 | To foster problem-solving skills and creative thinking, enabling students to stay ahead of technological trends, tools, and systems while addressing the evolving needs of users in the IT industry. |
| PSO3 | To empower students to become skilled software developers by strengthening managerial skills along with ethical and moral values. |

# MIT Academy of Engineering, Alandi, Pune

**An Autonomous Institute affiliated to Savitribai Phule Pune University**

## COMMON CURRICULUM FRAMEWORK (NEP Revision)

The Bachelor of Technology Program shall be based on the following type of courses.

| COURSE AND CREDIT DISTRIBUTION: SEMESTER-WISE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.N. | TYPE OF COURSE | NO. OF COURSES/SEMESTER (CREDITS) | | | | | | | | Total Courses | Total Credits | % |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | |
| 1. | Basic Science Courses (BSC) | 2(7) | 2(8) | | | | | | | 4 | 15 | 9 |
| 2. | Engineering Science (ESC) | 3(8) | 2(6) | | | | | | | 5 | 14 | 9 |
| 3. | Program Core Course (PCC) | | 1(2) | 3(10) | 3(10) | 2(8) | 2(8) | 1(4) | 1(4) | 13 | 46 | 27 |
| 4. | Program Elective Course (PEC) | | | | | 1(4) | 1(4) | 1(4) | 1(3) | 5 | 15 | 9 |
| 5 | Vocational and Skill Enhancement Course (VSEC) | 1(2) | 1(2) | 1(2) | 1(2) | 1(2) | 1(2) | 1(2) | | 6 | 12 | 7 |
| 6 | Multi-Disciplinary Minor(MDM) | | | | 1(3) | 1(3) | 1(3) | 1(2) | 1(3) | 5 | 14 | 8 |
| 7 | Open Elective (OE) | | | 1(2) | 1(4) | | | | 1(2) | 3 | 8 | 5 |
| 8 | Ability Enhancement Courses (HSSM AEC) | 1(2) | | | | | 1(2) | | | 2 | 4 | 2 |
| 9 | Management/Entrepreneurship/Economics Courses (HSSM MEC) | | | 1(2) | | | | 1(2) | | 2 | 4 | 2 |
| 10 | Indian Knowledge System (HSSM IKS) & Co-curricular (CC) | 2(3) | 1(2) | | | | | | | 3 | 5 | 3 |
| 11 | Value Education Course (HSSM VEC) | | | 1(3) | 1(2) | | | | | 2 | 5 | 3 |
| 12 | Experiential Learning/ Project/ Field Work/Community (ELC PRJ) | | | 1(1) | 1(1) | 1(2) | 1(2) | 0/2 (4) | 0/2 (4) | 6 | 10 | 6 |
| 13 | Experiential Learning Summer/ Semester Long Internship (ELC SI) | | | 1(2) | | 1(2) | | 1(4) | 1(8) | 4 | 16 | 10 |
| **Audit Courses** | | 1 | | | 1 | | | | | 2 | 0 | 0 |
| **TOTAL** | | 8 (21) | 8 (21) | 9 (22) | 9 (22) | 7 (21) | 7 (21) | 7 (20) | 5 20) | 62 | 168 | 100 |

| CREDITS (CONTACT HOURS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 Lecture Hour = 1 Credit, 2 Lab Hours = 1 Credit, 1 Tutorial Hour = 1 Credit | | | | | | | |
| SL. NO. | YEAR | SEMESTER CREDIT | | | SEMESTER CONTACT HOURS | | |
| | | 1 | 2 | TOTAL | 1 | 2 | TOTAL |
| 1. | First Year | 21 | 21 | 42 | 27 | 29 | 56 |
| 2. | Second Year | 22 | 22 | 44 | 29 | 34 | 63 |
| 3. | Third Year | 21 | 21 | 42 | 27 | 31 | 58 |
| 4. | Final Year | 20 | 20 | 40 | 19(10) | 14 | 33(24) |
| TOTAL | | | | 168 | | | 210(201) |

| COURSE CATEGORIES ABBREVIATION | |
|---|---|
| BSC | Basic Science Course |
| ESC | Engineering Science Course |
| PCC | Programme Core Course |
| PEC | Programme Elective Course |
| MDM | Multi-Disciplinary Minor |
| OE | Open Elective |
| VSEC | Vocational and Skill Enhancement Course |
| HSSM AEC | Humanities Social Science Management Ability Enhancement Courses |
| HSSM MEC | Humanities Social Science Management/Entrepreneurship/ Economics Course |
| HSSM IKS | Humanities Social Science Management Indian Knowledge System |
| HSSM VEC | Humanities Social Science and Management Value Education Course |
| ELC PRJ | Experiential Learning Course Project/ Field Work/ Community Engagement Project |
| ELC SI | Experiential Learning Course Student's Internship (Summer/ Semester Long/ Year Long) |
| CC | Co-Curricular Courses |

| ABBREVIATIONS | | | |
|---|---|---|---|
| TH | Theory Lecture | CA | Continuous Assessment |
| P | Practical Lab | T/P | Term Work / Practical |
| TU | Tutorial | DM | Demonstration |
| IA | Internal Assessment | Lab | Laboratory |
| MSE | Mid Semester Exam | | |
| ESE | End Semester Exam | | |

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# First Year

# Bachelor of Technology

# Information Technology

## NEP REVISION

(With Effect from Academic Year:2026-27)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| FIRST YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

| SEMESTER: I INFORMATION TECHNOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2301186 - Universal Human Values (Induction Program) | | | | | | | | | | | | |
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT/TUT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| BSC | 2301101T | Calculus and Differential Equations | 3 | - | 1 | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301101TU | Calculus and Differential Equations | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 |
| BSC | 2301104T | Science of Nature | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301104L | Science of Nature Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2304101T | Foundations of Computing | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2304101L | Foundations of Computing Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2303101T | Applied Mechanics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2303101L | Applied Mechanics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2309101T | Design Thinking | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2309101L | Design Thinking Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| VSEC | 2308161T | Data Driven Modeling | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2308161L | Data Driven Modeling Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| CC | 2301182 | Liberal Learning | - | 2 | - | - | - | - | - | 50 | 50 | 1 |
| HSSM IKS | 2308181 | Indian Knowledge System (Vedic Mathematics) | 2 | - | - | 25 | - | 50 | - | - | 75 | 2 |
| TOTAL | | | 14 | 12 | 1 | | | | | | 825 | 21 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| FIRST YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

| SEMESTER: II INFORMATION TECHNOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| BSC | 2301103T | Statistics and Integral Calculus | 3 | - | 1 | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301103TU | Statistics and Integral Calculus Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 |
| BSC | 2301102T | Engineering Physics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2301102L | Engineering Physics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2307101T | Electrical and Electronics Engineering | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2307101L | Electrical and Electronics Engineering Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2303101T | Essentials of Data Science | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2303101L | Essentials of Data Science Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| VSEC | 2308162T | Data Visualization | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2308162L | Data Visualization Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| PCC | 2308111T | Discrete Structure | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| HMMS AEC | 2301111L | Communication Skills (English) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2301112/3/4T | Communication Skills (German/Japanese/French) | 2 | - | - | 35 | - | 40 | - | - | 75 | |
| CC | 2307183 | Creative Technologies | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| TOTAL | | | 12 | 16 | 1 | | | | | | 825 | 21 |

*Two Credit Internships need to be completed after Completion of the First Year.

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## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# Second Year

# Bachelor of Technology

# Information Technology

## NEP REVISION

(With Effect from Academic Year: )

| BoS Chairman | Member Secretary | Chairman |
|---|---|---|
| Information | Academic Council | Academic Council |
| Technology | Dean Academics | Director MITAOE |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| SECOND YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

**SEMESTER: III (INFORMATION TECHNOLOGY)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2308211T | Data Communication | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2308211L | Data Communication Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2308212T | Data Structures | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| PCC | 2308213T | Computer Graphics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| PCC | 2308214L | Programming Lab | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| VSEC | 2308261L | Problem Solving Using OOP(C++) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2308262L | Problem-Solving Using OOP(Java) | | | | | | | | | | |
| HSSM VEC | 2301286T | Environmental Science | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| HSSM VEC | 2301287 | Universal Human Values-II | 1 | 4 | - | - | - | 25 | - | 75 | 100 | 3 |
| HSSM MEC | 2301276 | Entrepreneurship Skills | 1 | 2 | - | - | - | 25 | 20 | 30 | 75 | 2 |
| ELC PRJ | 2308291L | Project Design | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ELC SI | 2308296L | Internship (Life And Soft Skills) | - | - | - | - | - | - | - | 75 | 75 | 2 |
| **TOTAL** | | | **11** | **18** | | | | | | | **825** | **22** |

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|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| SECOND YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

**SEMESTER: IV (INFORMATION TECHNOLOGY)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2308216T | Database Management System | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2308216L | Database Management System Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2308219T | Advanced Data Structures | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2308219L | Advanced Data Structures Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2308220T | Theory of Computation | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| VSEC | 2308268L | Object Oriented Programming (Core Java) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2308269L | Enterprise Application Development (Advance Java) | | | | | | | | | | |
| MDM | *MDM List | MDM Course-I | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | *MDM List | MDM Course-I Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| OE | 2301254T | Open Elective (Applied Maths) | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301254L | Open Elective (Applied Maths) Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| OE | 23BD251L | Prototyping | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 23XX25X | Open Elective | 2 | - | - | 35 | - | 40 | - | - | | |
| ELC PRJ | 2308292L | Project Implementation | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| Audit | 2301281A | Indian Constitution | 1 | - | - | - | - | - | - | - | Audit | |
| TOTAL | | | 16 | 18 | - | | | | | | 850 | 22 |

*Two Credit Internships need to be completed after Completion of the Second Year.

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## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# Third Year

# Bachelor of Technology

# Information Technology

## NEP REVISION

(With Effect from Academic Year: )

| BoS Chairman | Member Secretary | Chairman |
|---|---|---|
| Information Technology | Academic Council Dean Academics | Academic Council Director MITAOE |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| THIRD YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

| SEMESTER: V (INFORMATION TECHNOLOGY) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2308311T | Operating Systems | 3 | - | - | 20 | 30 | 50 | - | - | 100 | 3 | |
| | 2308311L | Operating Systems Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| PCC | 2308312T | Computer Networks | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2308312L | Computer Networks Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| PEC | 2308321T | Exploratory Data Analytics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2308322T | Artificial Intelligence Machine Learning | | | | | | | | | | | |
| | 2308323T | Cloud Computing Foundation | | | | | | | | | | | |
| | 2308324T | Cryptography and Information Security | | | | | | | | | | | |
| | 2308321L | Exploratory Data Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| | 2308322L | Artificial Intelligence Machine Learning Lab | | | | | | | | | | | |
| | 2308323L | Cloud Computing Foundation Lab | | | | | | | | | | | |
| | 2308324L | Cryptography and Information Security Lab | | | | | | | | | | | |
| VSEC | 2308361L | Linux Administration-I | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| | 2308362L | Web Technology | | | | | | | | | | | |
| | 2308363L | Mobile Application Development | | | | | | | | | | | |
| | 2308364L | UI/UX Design | | | | | | | | | | | |
| MDM | *MDM List | MDM Course-II | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | *MDM List | MDM Course-II Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ELC PRJ | 2308391L | Major Project - I | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| ELC SI | 2308396L | Internship (Technical) | - | - | - | - | - | - | - | 75 | 75 | 2 | |
| TOTAL | | | 11 | 16 | - | | | | | | 800 | 21 | |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| THIRD YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

| SEMESTER: VI (INFORMATION TECHNOLOGY) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| | | | Hour/Week | | | THEORY | | | PRACT | | TOTAL | | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2308313T | Software Engineering | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2308313L | Software Engineering Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| PCC | 2308314T | Design & Analysis of Algorithms | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2308314L | Design & Analysis of Algorithms Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| PEC | 2308326T | Predictive Analytics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2308327T | Deep Learning | | | | | | | | | | | |
| | 2308328T | Cloud Native Application Development | | | | | | | | | | | |
| | 2308329T | Cyber Security & Forensics | | | | | | | | | | | |
| | 2308326L | Predictive Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| | 2308327L | Deep Learning Lab | | | | | | | | | | | |
| | 2308328L | Cloud Native Application Development Lab | | | | | | | | | | | |
| | 2308329L | Cyber Security & Forensics Lab | | | | | | | | | | | |
| VSEC | 2308366L | Linux Administration-II | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| | 2308367L | Cloud Services | | | | | | | | | | | |
| | 2308368L | Applied AI Engineering | | | | | | | | | | | |
| | 2308369L | Web and Desktop Application Development | | | | | | | | | | | |
| MDM | *MDM List | MDM Course-III | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | *MDM List | MDM Course-III Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| HSSM AEC | 2301371L | Employability and Career Development | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| ELC PRJ | 2308392L | Major Project - II | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| TOTAL | | | 11 | 20 | - | | | | | | 800 | 21 | |

*Four Credit Internship needs to be completed after Completion of the Third Year

MIT | Academy of Engineering

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## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# Final Year

# Bachelor of Technology

# Information Technology

## NEP REVISION

(With Effect from Academic Year:)

| BoS Chairman | Member Secretary | Chairman |
|---|---|---|
| Information Technology | Academic Council Dean Academics | Academic Council Director MITAOE |

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

**SEMESTER: VII INFORMATION TECHNOLOGY (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2308411T | System Design | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 2308421T | Big Data Analytics | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2308422T | Generative AI Applications | | | | | | | | | | |
| | 2308423T | Cloud Native DevOps | | | | | | | | | | |
| | 2308424T | Ethical Hacking & Cyber Laws | | | | | | | | | | |
| | 2308421L | Big Data Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2308422L | Generative AI Applications Lab | | | | | | | | | | |
| | 2308423L | Cloud Native DevOps Lab | | | | | | | | | | |
| | 2308424L | Ethical Hacking & Cyber Laws Lab | | | | | | | | | | |
| MDM | *MDM List | MDM Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| HSSM MEC | 2308476T | Infrastructure Management | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2308491L | Major Project - III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC PRJ | 2308492T | Research Methodology | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC SI | 2308496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| **TOTAL** | | | **13** | **6** | **-** | | | | | | **750** | **20** |

**SEMESTER: VIII INFORMATION TECHNOLOGY (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2308412T | Cyber Security | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 230842XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 23XXSWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| MDM | *MDM List | MDM Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 23XXSWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| OE | 2308451 | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2308497L | Semester-Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 2308498L | Semester Exchange | - | - | - | - | - | - | | | | |
| | 2308493L | Capstone Portfolio | - | - | - | - | - | - | | | | |
| **TOTAL** | | | **10** | **4** | | | | | | | **725** | **20** |

*Credits earned in advance through a credit transfer scheme

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

| SEMESTER: VII INFORMATION TECHNOLOGY (PART B) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2308411T | System Design | 4 | - | - | 60 | - | 90 | - | - | 150 | | 4 |
| MDM | *MDM List | Multidisciplinary Minor Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | | 2 |
| ELC PRJ | 2308491L | Major Project - III | - | 4 | - | - | - | - | 35 | 40 | 75 | | 2 |
| ELC SI | 2308499L | Industry Practicum | - | - | - | - | - | - | 150 | 150 | 300 | | 8 |
| ELC SI | 2308496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | | 4 |
| TOTAL | | | 6 | 4 | - | | | | | | 750 | | 20 |

| SEMESTER: VIII INFORMATION TECHNOLOGY (PART B) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2308412T | Cyber Security | 4 | - | - | 60 | - | 90 | - | - | 150 | | 4 |
| PEC | 230842XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | | 3 |
| | 2308SWXX | SWAYAM Course* (PEC) | - | - | - | 25 | - | 75 | - | - | | | |
| MDM | *MDM List | MDM Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | | 3 |
| | 23XXSWXX | SWAYAM Course* (MDM) | - | - | - | 25 | | 75 | - | - | | | |
| OE | 2308451L | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | | 2 |
| ELC SI | 2308497L | Semester-Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | | 8 |
| | 2308498L | Semester Exchange | - | - | - | - | - | - | | | | | |
| | 2308493L | Capstone Portfolio | - | - | - | - | - | - | | | | | |
| TOTAL | | | 10 | 4 | | | | | | | 725 | | 20 |

*Credits earned in advance through a credit transfer scheme

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | : | |
| EXIT CRITERIA BACHELOR OF TECHNOLOGY | RELEASE DATE | : | |
| | REVISION NO. | : | |

| Program | Exit after | Courses | Credits | Total |
|---|---|---|---|---|
| INFORMATION TECHNOLOGY | First Year | Internship | 4 | 8 |
| | | Database Management System | 4 | |
| | Second Year | Internship | 4 | 8 |
| | | Software Engineering | 4 | |
| | Third Year | Internship | 4 | 8 |
| | | Data Center Design | 4 | |

| Basic Science Courses (BSC): 4 Courses and 15 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301101T | Calculus and Differential Equations | 4 |
| 2. | 2301102T | Engineering Physics | 2 |
| | 2301102L | Engineering Physics Lab | 1 |
| 3. | 2301103T | Statistics and Integral Calculus | 3 |
| | 2301103T | Statistics and Integral Calculus Lab | 1 |
| 4. | 2301104T | Science of Nature | 3 |
| | 2301104L | Science of Nature Lab | 1 |

| Engineering Science (ESC):5 Courses and 14 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2307101T | Electrical and Electronics Engineering | 2 |
| | 2307101L | Electrical and Electronics Engineering Lab | 1 |
| 2. | 2304101T | Foundations of Computing | 2 |
| | 2304101L | Foundations of Computing Lab | 1 |
| 3. | 2304102T | Essentials of Data Science | 2 |
| | 2304102L | Essentials of Data Science Lab | 1 |
| 4. | 2303101T | Applied Mechanics | 2 |
| | 2303101L | Applied Mechanics Lab | 1 |
| 5. | 2309101T | Design Thinking | 1 |
| | 2309101L | Design Thinking Lab | 1 |

| Program Core Course (PCC): 14 Courses and 46 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2308111T | Discrete Structure | 2 |
| 2 | 2308211T | Data Communication | 2 |
| | 2308121T | Data Communication Lab | 1 |
| 3. | 2308212T | Data Structures | 3 |
| 4. | 2308213T | Computer Graphics | 2 |
| 5. | 2308214L | Programming Lab | 2 |
| 6. | 2308219T | Advanced Data Structures | 2 |
| | 2308219L | Advanced Data Structures Lab | 1 |
| 7. | 2308216T | Database Management System | 3 |
| | 2308216L | Database Management System Lab | 1 |
| 8. | 2308220T | Theory of Computation | 3 |
| 9. | 2308311T | Operating Systems | 3 |
| | 2308311L | Operating Systems Lab | 1 |
| 10. | 2308312T | Computer Networks | 3 |
| | 2308312L | Computer Networks Lab | 1 |
| 11. | 2308313T | Software Engineering | 3 |
| | 2308313L | Software Engineering Lab | 1 |
| 12. | 2308314T | Design & Analysis of Algorithms | 3 |
| | 2308314L | Design & Analysis of Algorithms Lab | 1 |
| 13. | 2308411T | System Design | 4 |
| 14. | 2308412T | Cyber Security | 4 |

| Program Elective Course (PEC): 4 Courses and 15 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2308321T | Exploratory Data Analytics | 3 |
| | 2308322T | Artificial Intelligence Machine Learning | |
| | 2308323T | Cloud Computing Foundation | |
| | 2308324T | Cryptography and Information Security | |
| | 2308321L | Exploratory Data Analytics Lab | 1 |
| | 2308322L | Artificial Intelligence Machine Learning Lab | |
| | 2308323L | Cloud Computing Foundation Lab | |
| | 2308324L | Cryptography and Information Security Lab | |
| 2. | 2308326T | Predictive Analytics | 3 |
| | 2308327T | Deep Learning | |
| | 2308328T | Cloud Native Application Development | |
| | 2308329T | Cyber Security Forensics | |
| | 2308326L | Predictive Analytics Lab | 1 |
| | 2308327L | Deep Learning Lab | |
| | 2308328L | Cloud Native Application Development Lab | |
| | 2308329L | Cyber Security Forensics Lab | |
| 3. | 2308421T | Big Data Analytics | 3 |
| | 2308422T | Generative AI Applications | |
| | 2308423T | Cloud Native DevOps | |
| | 2308424T | Ethical Hacking & Cyber Laws | |
| | 2308421L | Big Data Analytics Lab | 1 |
| | 2308422L | Generative AI Applications Lab | |
| | 2308423L | Cloud Native DevOps Lab | |
| | 2308424L | Ethical Hacking & Cyber Laws Lab | |
| 4. | 2308SWXX | SWAYAM Course | 3 |

| List of SWAYAM Courses | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 23XXSW01 | SWAYAM Course | 3 |
| 2 | 23XXSW02 | SWAYAM Course | |
| 3. | 23XXSW03 | SWAYAM Course | |
| 4. | 23XXSW04 | SWAYAM Course | |
| 5. | 23XXSW05 | SWAYAM Course | |

| Vocational and Skill Enhancement Course (VSEC): 6 Courses and 12 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2308161L | Linux Fundamentals and Programming | 2 |
| 2. | 2308162L | Data Visualization | 2 |
| 3. | 2308261L | Problem Solving Using Object Oriented Programming(C++) | 2 |
| | 2308262L | Problem Solving Using Object Oriented Programming (Java) | |
| 4. | 2308268L | Object Oriented Programming (Core Java) | 2 |
| | 2308269L | Enterprise Application Development (Advance Java) | |
| 5. | 2308361L | Linux Administration-I | 2 |
| | 2308362L | Web Technology | |
| | 2308363L | Mobile Application Development | |
| | 2308364L | UI/UX Design | |
| 6. | 2308366L | Linux Administration-II | 2 |
| | 2308367L | Cloud Services | |
| | 2308368L | Practitioner's Approach to AI | |
| | 2308369L | Web and Desktop Application Development | |

| Open Elective (OE): 3 Courses and 8 Credits | | | | |
|---|---|---|---|---|
| **Sl. No.** | **Offering School** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | SHES (Mathematics) | 2301251T | Applied Mathematics | 3 |
| | | 2301251L | Applied Mathematics Lab | 1 |
| | | 2301252T | Applied Mathematics | 3 |
| | | 2301252L | Applied Mathematics Lab | 1 |
| | | 2301253T | Applied Mathematics | 3 |
| | | 2301253L | Applied Mathematics Lab | 1 |
| | | 2301254T | Applied Mathematics | 3 |
| | | 2301254L | Applied Mathematics Lab | 1 |
| | | 2301255T | Applied Mathematics | 3 |
| | | 2301255L | Applied Mathematics Lab | 1 |
| | | 2301256T | Applied Mathematics | 3 |
| | | 2301256L | Applied Mathematics Lab | 1 |
| | | 2301257T | Applied Mathematics | 3 |
| | | 2301257L | Applied Mathematics Lab | 1 |
| 2. | B. Design | 23BD251T | Prototyping | 2 |
| 3. | SHES | 230145XXL | Professional Certification Course | 2 |

| Humanities Social Science and Management Ability Enhancement Courses (HSS AEC): 2 Courses and 4 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301171/2/3/4 | Communication Skills (English/ German/Japanese/French) | 2 |
| 2. | 2301371L | Employability and Career Development | 2 |

| Humanities Social Science Management/Entrepreneurship/Economics(HSS MEC): 2 Courses and 4 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301276 | Entrepreneurship Skills | 2 |
| 2. | 2308476T | Infrastructure Management | 2 |

| Humanities Social Science and Management Value Education Course (HSSM VEC): 3 Courses and 5 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301186 | Universal Human Values-I | Audit |
| 2. | 2301286 | Environmental Science | 2 |
| 3. | 2301287 | Universal Human Values-II | 3 |

| Humanities Social Science and Management Indian Knowledge System / Co-Curricular Courses (HSSM IKS / CC): 4 Courses and 5 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2308181T | Indian Knowledge System - (Vedic Mathematics) | 2 |
| 2. | 2301182L | Liberal Learning - (HSSM CC) | 1 |
| 3. | 2307183L | Creative Technologies - (HSSM CC) | 2 |
| 4. | 2301281A | Indian Constitution | Audit |

| Experiential Learning Course Project/Field Work/Community Project(ELC PRJ): 6 Courses and 10 Credit | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2308291L | Project Design | 1 |
| 2. | 2308292L | Project Implementation | 1 |
| 3. | 2308391L | Major Project - I | 2 |
| 4. | 2308392L | Major Project - II | 2 |
| 5. | 2308491L | Major Project - III | 2 |
| 6. | 2308492T | Research Methodologies | 2 |
| (optional) | 2308493L | Capstone Portfolio | 8 |

| Experiential Learning Course Student's Internship (Summer/Semester Long) (ELC SI): 4 Courses and 16 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2308296L | Internship (Life And Soft Skills) | 2 |
| 2. | 2308396L | Summer Internship (Technical) | 2 |
| 3. | 2308496L | Summer Internship (Technical) | 4 |
| 4. | 2308497L | Semester Long Internship | 8 |
| (optional) | 2308498L | Semester Exchange | 8 |
| (optional) | 2308299L | Industry Internship | 8 |

| Multi-Disciplinary Minor (MDM) List: 05 Courses and 14 Credits | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Programme Name | Track Name | Semester IV (MDM-I, 3 Credits) | | Semester V (MDM-II, 3 Credits) | | Semester VI (MDM-III, 3 Credits) | | Semester VII (MDM-IV, 2 Credits) | | Semester VIII (MDM-V, 3 Credits) | |
| | | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name |
| Chemical Engineering | Chemical Engineering (Green Technology and Sustainability Engineering) | 2301232 (T+L) | Engineering Informatics (T+L) | 2305331 (T+L) | Sustainability & Green Technology (T+L) | 2305332 (T+L) | Sustainable Bio-energy and Bio-products (T+L) | 2305431T | Green energy conversion systems | 2305SWXX | SWAYAM Course |
| | Chemical Engineering (Industrial Technology Management) | 2301232 (T+L) | Engineering Informatics (T+L) | 2305333 (T+L) | Management of Technology (T+L) | 2305334 (T+L) | Product Management (T+L) | 2305432T | Product Design and Process Development | 2305SWXX | SWAYAM Course |
| Civil Engineering | Civil Engineering (Infrastructure and Sustainability | 2301232 (T+L) | Engineering Informatics (T+L) | 2303331 (T+L) | Smart Cities (T+L) | 2303332 (T+L) | Sustainable Engineering (T+L) | 2303431T | Integrated Environmental Planning & Assessment | 2303SWXX | SWAYAM Course |
| Computer Engineering | Computer Engineering | 2301232 (T+L) | Engineering Informatics (T+L) | 2304331 (T+L) | Data Structures & Algorithms (T+L) | 2304332 (T+L) | Database Management Systems (T+L) | 2304431T | Software Engineering | 2304SWXX | SWAYAM Course |
| Software Engineering | Software Engineering | 2301232 (T+L) | Engineering Informatics (T+L) | 2310331 (T+L) | Software Architecture (T+L) | 2310332 (T+L) | Software Testing (T+L) | 2310431T | Software Quality Management | 2310SWXX | SWAYAM Course |
| Computer Science & Engineering (AIML) | Artificial Intelligence and Machine Learning | 2301232 (T+L) | Engineering Informatics (T+L) | 2311331 (T+L) | Artificial Intelligence & Machine Learning (T+L) | 2311332 (T+L) | Deep Learning (T+L) | 2311431T | Generative AI | 2311SWXX | SWAYAM Course |
| | Healthcare Technologies | 2301232 (T+L) | Engineering Informatics (T+L) | 2311333 (T+L) | Fundamentals of Healthcare Technologies (T+L) | 2311334 (T+L) | Healthcare Informatics (T+L) | 2311432T | AI in Healthcare | 2311SWXX | SWAYAM Course |
| Computer Science & Engineering (DS) | Data Science | 2301232 (T+L) | Engineering Informatics (T+L) | 2312331 (T+L) | Data Analytics (T+L) | 2312332 (T+L) | Predictive Analytics (T+L) | 2312431T | Big Data Analytics | 2312SWXX | SWAYAM Course |

| Multi-Disciplinary Minor (MDM): 05 Courses and 14 Credits | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Programme Name | Track Name | Semester IV (MDM-I, 3 Credits) | | Semester V (MDM-II, 3 Credits) | | Semester VI (MDM-III, 3 Credits) | | Semester VII (MDM-IV, 2 Credits) | | Semester VIII (MDM-V, 3 Credits) | |
| | | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name |
| Information Technology | Cloud Computing | 2301232 (T+L) | Engineering Informatics (T+L) | 2308331 (T+L) | Cloud Computing Foundations (T+L) | 2308332 (T+L) | Cloud-Native Application Development (T+L) | 2308431T | Cloud Native DevOps | 2308SWXX | SWAYAM Course |
| Electronics Engineering | Blockchain Technologies | 2301232 (T+L) | Engineering Informatics (T+L) | 2306331 (T+L) | Cyber Security Essentials (T+L) | 2306332 (T+L) | Network Security (T+L) | 2306431T | Blockchain Technology Applications | 2306SWXX | SWAYAM Course |
| Mechanical Engineering | Computer Aided Engineering and Automation | 2301232 (T+L) | Engineering Informatics (T+L) | 2309331 (T+L) | CAD Automation and Customisation (T+L) | 2309332 (T+L) | Computer Aided Simulation (T+L) | 2309431T | Industrial Automation | 2309SWXX | SWAYAM Course |
| SHES (Entrepreneurship) | Innovation and Entrepreneurship | 2301232 (T+L) | Engineering Informatics (T+L) | 2301331 (T+L) | Foundation of Entrepreneurship (T+L) | 2301332 (T+L) | Venture Development | 2301431T | Startup Incubation & Fund Raising | 2301SWXX | SWAYAM Course |
| MITACSC | Business Administration | 2301232 (T+L) | Engineering Informatics (T+L) | 2301333 (T+L) | Principles and Practices of Management (T+L) | 2301334 (T+L) | Organizational Behavior | 2301432T | Managerial Economics | 2301SWXX | SWAYAM Course |
| SHES | Lean Management | 2301232 (T+L) | Engineering Informatics (T+L) | 2301335 (T+L) | Foundations of Lean Manufacturing Process | 2301336 (T+L) | Advance Lean manufacturing | 2301433T | Lean Manufacturing Project | 2301SWXX | SWAYAM Course |
| B. Design | Design for Engineers | 2301232 (T+L) | Engineering Informatics (T+L) | 23BD331 (T+L) | Design Fundamentals | 23BD332 (T+L) | Packaging Design | 23BD431T | Introduction to UI-UX | 23BDSWXX | SWAYAM Course |

# MIT Academy of Engineering, Alandi, Pune

**An Autonomous Institute affiliated to SavitribaiPhule Pune University**

## ELIGIBILITY CRITERION

FIRST YEAR ADMISSION

1) MAHARASHTRA STATE CANDIDATURE CANDIDATE.

The Candidate should be an Indian National, Passed HSC or its equivalent examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry or Biotechnology or Biology or Technical or Vocational subjects and obtained at least 50 % marks(at least 45% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only) in the above subjects taken together. Passed Diploma in Engineering and Technology and obtained at least 50% marks (at least 45 % marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only). Passed B.Sc. Degree from a Recognised University as defined by UGC and obtained at least 50 % marks (at least 45 % marks, in case of backward class categories and Persons with Disability candidates belonging to Maharashtra State only). Obtained score in CET conducted by the Competent Authority.

2) ALL INDIA CANDIDATURE CANDIDATES, JAMMU AND KASHMIR MIGRANT CANDIDATURE CANDIDATES.

The Candidate should be an Indian National.
Passed HSC or its equivalent examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry or Biotechnology or Biology or Technical or Vocational subjects and obtained at least 50 % marks (at least 45 % marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only) in the above subjects taken together.

OR
Passed Diploma in Engineering and Technology and obtained at least 50 % marks (at least 45 % marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only).

OR
Passed B.Sc. Degree from a Recognised University as defined by University Grants Commission and obtained at least 50 % marks (at least 45 % marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only).
Obtained score in CET or JEE Main Paper I.
Any other criterion declared by appropriate authority from time to time.

# MIT Academy of Engineering, Alandi, Pune

**An Autonomous Institute affiliated to SavitribaiPhule Pune University**

## PROGRAMME OBJECTIVES

## INFORMATION TECHNOLOGY

The program's goal is to provide a professionally guided education in INFORMATION TECHNOLOGY that prepares graduates to transition into a broad range of career options: industry, government, computing graduate program, and professional education.

Within four years of completion, graduates exhibit the following characteristics:

1. Demonstrates agility in solving software and system challenges with a comprehensive set of skills appropriate to the needs of the dynamic global computing-based society.
2. Capable of diverse team and organizational leadership in computing project settings.
3. Demonstrates ethical principles in the application of computing-based solutions to societal and organizational problems.
4. Continually acquires skills and knowledge to support a professional pathway, including communication, analytic, and technical skills.

## Examination Manual

(Excerpt from the Examination Manual)

### 10. The Grading System

i) For every course taken by a student he/she is assigned a grade based on his/her performance in all the assessments including ISE, IA and ESE. Performance is first quantified as marks and then assigned letter grades

The grade indicates a qualitative assessment of the student's performance and is associated with an equivalent number called a grade point.

ii) The academic performance shall be graded on a 10 point scale. The letter grades and their equivalent grade points are listed in Table II.

iii) The Absolute grading system is followed, grades are allotted as per the Table below

| Grades | Range of Marks | Grade Points | Description |
|---|---|---|---|
| AA | 80-100 | 10 | Outstanding |
| AB | 70-79 | 9 | Excellent |
| BB | 60-69 | 8 | Very good |
| BC | 55-59 | 7 | Good |
| CC | 50-54 | 6 | Satisfactory |
| CD | 45-49 | 5 | Average |
| DD | 40-44 | 4 | Marginal |
| FF | 00-39 | 0 | Fail (Permitted to repeat ESE) |
| XX | | -- | Detained (Re register for the course) |
| NP | | -- | Absent for the examination |

| | | | |
|---|---|---|---|
| | | | (Permitted to repeat ESE) |
| PP | | -- | Completed the Audit Course successfully |
| NN | | -- | Not completed the audit course |

Table II : The grading System

iii) The letter grades (up to DD only) awarded to a student in all the courses shall be converted into a semester and cumulative grade point average to be calculated following the procedure given in section 10.2.

**The Grading Process**

i) The marks of the ISE, IA and ESE will be used to decide the total marks for each student. If the total has a fractional part then it shall be rounded off to the next integer.

ii) The grades will then be assigned to each student.

iii) The grades will be then examined and verified by the Examination Moderation committee.

**Performance Indices**

**Calculation of Semester Grade Point Average (SGPA)**

The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the Semester.

$$SGPA = \frac{\sum_{i=1}^{n} CiPi}{\sum_{i=1}^{n} Ci}$$

Where,

Ci= The number of credits earned in the ith course of a semester for which SGPA is to be calculated.

Pi=Grade point earned in the ith course i=1, 2, ..... , n represent the number of courses in which a student is registered in the concerned semester

The SGPA is calculated to two decimal places.

**Calculation of Cumulative Grade point Average (CGPA)**

An up-to-date assessment of the overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is the weighted average of the grade points obtained in all the courses in prescribed semesters for the UG/PG Programs. CGPA for a student of undergraduate/postgraduate Programs shall be calculated only when the grade point (minimum up to pass marks) of all the semester examinations is available.

$$CGPA = \frac{\sum_{j=1}^{N} CjPj}{\sum_{j=1}^{N} Cj}$$

Where,

Cj =The number of credits earned in the jth course up to the semester for which CGPA is to be calculated.

Pj =Grade point earned in the jth course. A grade point less than 4 in a undergraduate course shall not be taken into consideration for calculation of CGPA.

j = 1, 2, ..... , m represent the number of courses in which a student is registered up to the semester for which the CGPA is to be calculated.

The CGPA is also calculated to two decimal places.

**Guidelines for the Award of Grades:**

The following are the general guidelines for the award of grades:

i) For each student, all evaluations in different components of a course shall be done in absolute marks considering the weight-age in teaching scheme.

ii) The marks of various components shall be added to get total marks secured on a 10-points scale. The rounding off shall be done on the higher side.

iii) An Examination moderation committee will be responsible for examining and analyzing the results.

iv) The course in-charge, course faculty and Grade moderation committee's decision regarding grade thresholds and grade allotment will be final.

Explanation for Grades

**i) Passing Grades** -The grades AA, AB, BB, BC, CC, CD and DD are passing grades. A candidate acquiring any one of these grades in a course shall be declared as passed. A student shall earn the credits for a course only if the student gets passing grade in that course.

**ii) FF Grade**

a) Letter grade FF in any course implies failure in that course.

b) A student who was awarded "FF" grade in a course has to repeat it compulsorily when it is offered next and until a passing grade is obtained.

**iii) The Transitional Grades NP and XX shall be awarded in the following cases:**

a) Grade NP to a student only on satisfactory attendance at classes and performance in other components of assessment, but absence from ESE/ECE in a semester for valid and convincing reasons acceptable to the Department, such as,

a. Illness or accident, which disabled him/her from appearing at the examination;
b. A calamity in the family at the time of the examination, which required the student to be away from the College;

b) Grades XX to a student on his/her overall performance in the course during the semester. This grade will be awarded to a student who is detained in that particular course.

**iv)** Both the SGPA and CGPA shall be rounded off to the second place of decimal and recorded as such for ease of presentation. Whenever the CGPAs are to be used for the purpose of determining the merit ranking in a group of students, only the rounded off values shall be made use of.

A student is considered to have completed a course successfully and earned the credits if he/she secures a letter grade other than

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

# MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# First Year

# Bachelor of Technology

# Information Technology

## NEP REVISION

(With Effect from Academic Year: )

| BoS Chairman | Member Secretary | Chairman |
|---|---|---|
| Information Technology | Academic Council Dean Academics | Academic Council Director MITAOE |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| FIRST YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

**SEMESTER: I INFORMATION TECHNOLOGY**

**2301186 - Universal Human Values (Induction Program)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT/TUT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| BSC | 2301101T | Calculus and Differential Equations | 3 | - | 1 | 30 | 20 | 50 | 20 | 30 | 150 | 4 |
| BSC | 2301104T | Science of Nature | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301104L | Science of Nature Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2304101T | Foundations of Computing | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2304101L | Foundations of Computing Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2303101T | Applied Mechanics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2303101L | Applied Mechanics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2309101T | Design Thinking | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2309101L | Design Thinking Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| VSEC | 2308161T | Data Driven Modeling | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2308161L | Data Driven Modeling Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| CC | 2301182 | Liberal Learning | - | 2 | - | - | - | - | - | 50 | 50 | 1 |
| HSSM IKS | 2308181 | Indian Knowledge System (Vedic Mathematics) | 2 | - | - | 25 | - | 50 | - | - | 75 | 2 |
| **TOTAL** | | | **14** | **12** | **1** | | | | | | **825** | **21** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| FIRST YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

| SEMESTER: II INFORMATION TECHNOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| BSC | 2301103 | Statistics and Integral Calculus | 3 | - | 1 | 30 | 20 | 50 | 20 | 30 | 150 | 4 |
| BSC | 2301102T | Engineering Physics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2301102L | Engineering Physics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2307101T | Electrical and Electronics Engineering | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2307101L | Electrical and Electronics Engineering Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2303101T | Essentials of Data Science | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2303101L | Essentials of Data Science Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| VSEC | 2308162T | Data Visualization | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2308162L | Data Visualization Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| PCC | 2308111T | Discrete Structure | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| HMMS AEC | 2301111L | Communication Skills (English) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2301112/ 3/4T | Communication Skills (German/Japanese/ French) | 2 | - | 35 | - | 40 | - | - | - | 75 | |
| CC | 2307183L | Creative Technologies | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| TOTAL | | | 12 | 16 | 1 | | | | | | 825 | 21 |

*Two Credit Internships need to be completed after Completion of the First Year.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Calculus and Differential Equations |
| | COURSE CODE | 2301101T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2301101T.CEO.1: To apply the concepts of partial differentiation.
2301101T.CEO.2: Demonstrate an understanding towards the applications of partial differentiation.
2301101T.CEO.3: Examine methods for solving first-order first-degree ordinary differential equations.
2301101T.CEO.4: Infer the applications of first-order differential equations.
2301101T.CEO.5: Determine the solution of linear differential equations of second and higher order.
2301101T.CEO.6: Solve first-order linear and nonlinear partial differential equations.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301101T.CO.1: Make use of properties of partial differentiation to solve the problems [L3].
2301101T.CO.2: Examine the applications of partial differentiation [L4].
2301101T.CO.3: Solve first-order and first-degree ordinary differential equations [L3].
2301101T.CO.4: Analyze real-world phenomenon governed by first-order ordinary differential equations [L4].
2301101T.CO.5: Apply concepts of solving linear differential equations of second and higher order governing different systems in engineering [L4].
2301101T.CO.6: Determine solutions of various partial differential equations by theoretical methods [L3].

## COURSE ABSTRACT

The course focuses on developing important mathematical concepts in a comprehensible, coherent and rigorous way. This is achieved by means of a carefully balanced approach by including the topics of calculus and differential equations which will foster the analytical thinking, and problem solving abilities of the students. Students are encouraged to apply their mathematical knowledge to solve problems and clear their doubts through tutorial sessions. Students embarking on this course will be able to identify and solve various differential equation problrms and will be intellectually equipped with the links between these concepts and their core engineering and real life problems. This course will enable them to tackle the problems of differential equations that they encounter in other engineering courses.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Partial Differentiation** | **08 HOURS** |

**Contents:** Partial Differentiation: Introduction, Chain rule, Total derivative, Change of variables, Homogeneous functions, Euler's theorem, Differentiation of implicit functions.
**Self Study:** Differentiation of implicit functions.

| | | |
|---|---|---|
| **UNIT 2** | **Applications Of Partial Differentiation** | **07 HOURS** |

**Applications/Case Study:** Maxima, Minima.
**Contents:** Jacobian, Jacobian of implicit functions, Partial derivative of an implicit function using Jacobians, Functional dependence, Maxima and Minima of functions of two variables.
**Self Study:** Jacobian of implicit functions.

| | | |
|---|---|---|
| **UNIT 3** | **Ordinary Differential Equations Of First Order And First Degree** | **07 HOURS** |

**Contents:** Exact differential equations, Differential equations, Reducible to exact form-Integrating factors, Linear differential equations, Differential equations reducible to linear form.
**Self Study:** Differential equations reducible to linear form.

| | | |
|---|---|---|
| **UNIT 4** | **Applications Of Ordinary Differential Equations Of First Order & First Degree** | **07 HOURS** |

**Applications/Case Study:** Electrical circuits.
**Contents:** Orthogonal trajectories, Newton's law of cooling, Growth & Decay, Electric circuits, Chem- ical applications- Mixing problems.
**Self Study:** Newton's law of cooling, Growth & Decay.

| | | |
|---|---|---|
| **UNIT 5** | **Linear Differential Equation Of Second Order & Higher Order** | **08 HOURS** |

**Applications/Case Study:** Mass-Spring systems.
**Contents:** General solutions of linear differential equations with constant coefficients,Shortcut meth- ods to find P.I., Method of variation of parameters, Equations reducible to linear differential equations with constant coefficients: Cauchy and Legendre's linear differential equations.
**Self Study:** Cauchy and Legendre's linear differential equations.
**Further Readings:** Simultaneous differnetial equations, Applications in Electric circuits, Mass-Spring systems etc.

| UNIT 6 | Partial Differential Equations | 08 HOURS |
|---|---|---|

**Contents:** Introduction and formation of a partial differential equation, solution of a partial differential equation, equations solvable by direct integration, Linear differential equations of the first order, Non-linear differential equations of the first order, Charpit's method.

**Further Readings:** Linear Homogeneous Partial Differential Equations.

## TEXT BOOKS


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.
2. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.


## REFERENCE BOOKS


1. Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379-8858). Addison-Wesley.
2. Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.
3. Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.
4. O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.
5. Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Calculus and Differential Equations Tutorial |
| | COURSE CODE | 2301101U |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 1 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2301101U.CEO.1: To apply the concepts of partial differentiation.
2301101U.CEO.2: Demonstrate an understanding towards the applications of partial differentiation.
2301101U.CEO.3: Examine methods for solving first-order first-degree ordinary differential equations.
2301101U.CEO.4: Infer the applications of first-order differential equations.
2301101U.CEO.5: Determine the solution of linear differential equations of second and higher order.
2301101U.CEO.6: Solve first-order linear and nonlinear partial differential equations.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301101U.CO.1: Make use of properties of partial differentiation to solve the problems [L3].
2301101U.CO.2: Examine the applications of partial differentiation [L4].
2301101U.CO.3: Solve first-order and first-degree ordinary differential equations [L3].
2301101U.CO.4: Analyze real-world phenomenon governed by first-order ordinary differential equations [L4].
2301101U.CO.5: Apply concepts of solving linear differential equations of second and higher order governing different systems in engineering [L4].
2301101U.CO.6: Determine solutions of various partial differential equations by theoretical methods [L3].

## COURSE ABSTRACT

The course focuses on developing important mathematical concepts in a comprehensible, coherent and rigorous way. This is achieved by means of a carefully balanced approach by including the topics of calculus and differential equations which will foster the analytical thinking, and problem solving abilities of the students. Students are encouraged to apply their mathematical knowledge to solve problems and clear their doubts through tutorial sessions. Students embarking on this course will be able to identify and solve various differential equation problrms and will be intellectually equipped with the links between these concepts and their core engineering and real life problems. This course will enable them to tackle the problems of differential equations that they encounter in other engineering courses.

| TUTORIALS | | |
|---|---|---|
| **TUTORIAL NO.01** | **Partial Differentiation** | **01 HOUR** |
| Problems On Partial Differentiation: Introduction, Chain rule, Total derivative, Change of variables. | | |
| **TUTORIAL NO.02** | **Partial Differentiation** | **01 HOUR** |
| Problems On Homogeneous functions, Euler's Theorem, Differentiation of Implicit functions. | | |
| **TUTORIAL NO.03** | **Applications of Partial Differentiation** | **01 HOUR** |
| Problems on Jacobian, Jacobian of Implicit functions, Partial derivative of an implicit function. | | |
| **TUTORIAL NO.04** | **Applications of Partial Differentiation** | **01 HOUR** |
| Problems on Functional dependence, Maxima and Minima of functions of two variables. | | |
| **TUTORIAL NO.05** | **Ordinary Differential Equations** | **01 HOUR** |
| Problems on Exact differential equations, Differential equations reducible to exact form-Integrating factors. | | |
| **TUTORIAL NO.06** | **Ordinary Differential Equations** | **01 HOUR** |
| Linear differential equations, Differential equations reducible to linear form. | | |
| **TUTORIAL NO.07** | **Applications of Ordinary Differential Equations** | **01 HOUR** |
| Orthogonal Trajectories, Newton's law of cooling, Growth & Decay. | | |
| **TUTORIAL NO.08** | **Applications of Ordinary Differential Equations** | **01 HOUR** |
| Electric circuits, Chemical applications- Mixing problems. | | |
| **TUTORIAL NO.09** | **Linear Differential Equations of Higher Order** | **01 HOUR** |
| General solutions of linear differential equations with constant coefficients, Shortcut methods to find P.I. | | |
| **TUTORIAL NO.10** | **Linear Differential Equations of Higher Order** | **01 HOUR** |
| Shortcut methods to find P.I., Method of variation of parameters, Cauchy and Legendre's linear differential equation. | | |

| TUTORIAL NO.11 | Partial Differential Equations | 01 HOUR |
|---|---|---|
| Introduction and formation of partial differential equation, solution of a partial differential equation, equations solvable by direct integration. | | |
| **TUTORIAL NO.12** | **Partial Differential Equations** | **01 HOUR** |
| Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method. | | |
| **TUTORIAL NO.13** | **Guest Lecture** | **02 HOUR** |
| Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method. | | |
| **TUTORIAL NO.14** | **Doubt Clearing Session** | **01 HOUR** |
| Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method. | | |

## TEXT BOOKS


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.
2. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.


## REFERENCE BOOKS


1. Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379-8858). Addison-Wesley.
2. Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.
3. Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.
4. O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.
5. Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF CHEMICAL ENGINEERING | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Science of Nature |
| | COURSE CODE | 2301104T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2301104T.CEO.1: Make students conversant with basic Biology regarding the life processes.

2301104T.CEO.2: Study biology and engineering as biologically inspired technologies like designs in nature, bioenergetics, bioprocesses, biomaterials, biomechanics, and bioinstrumentation.

2301104T.CEO.3: To define the role of chemistry for engineers via atomic structure and green chemistry principles.

2301104T.CEO.4: To define the basic aspects and applications of polymers, biomaterials & composites.

2301104T.CEO.5: To illustrate the basic principles, instrumentation & applications of analytical techniques.

2301104T.CEO.6: To outline the technology involved in improving quality of water for its industrial use.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301104T.CO.1: Explain important biological inventions that changed human life and their impact on engineering [L2].

2301104T.CO.2: Describe different biological processes with their technical aspects for Healthcare and environmental applications [L2].

2301104T.CO.3: Utilize knowledge of atomic structure, purification - separation techniques and green chemistry principles to evaluate their significance and application in engineering contexts [L3].

2301104T.CO.4: Implement chemical bonding theories and engineering material principles to assess the formation and properties of materials, including smart materials and nanomaterials, for their practical use in engineering solutions [L3].

2301104T.CO.5: Employ the basic principles and instrumentation techniques to perform and interpret analytical techniques relevant to engineering [L3].

2301104T.CO.6: Apply various technology strategies for water analysis and purification for improving water quality, focusing on its industrial applications, and ensuring adherence to environmental standards [L3].

## COURSE ABSTRACT

The fundamental objective of the Science of Nature course is to provide the extended knowledge of chemistry & biology required for engineering courses. The course defines the role of chemistry for engineers via topics like atomic structure & green chemistry principles. A few topics like Formation of Materials which covers chemical bonding and their influence on chemical properties & Engineering materials are included. This enables students to understand the application of chemistry in electronic gadgets, in construction, chemical compounds as a conducting materials, as smart materials, as nano materials viz carbon nano materials etc. Further, the analysis part involves various instrumental methods. It is aimed to give information about the advanced characterization and separation techniques of chemical compounds. The biology part of the course includes phenomena observed in nature viz., Physical, Chemical and Biological along with the case studies and applications. This gives much needed information about natural biological processes and their technical aspects in view of optimizing Engineering solutions. This promotes the applicability of engineering in understanding of chemistry/biology and visa-versa.

## THEORY COURSE CONTENTS

| UNIT 1 | Introduction to Science of Nature | 8 HOURS |
|---|---|---|

**Contents:** The basics of science of nature. Exploring science in nature, specially symmetry, spiral, golden ratio, pattern and fractal. The phenomenon observed in nature viz., Physical, Chemical and Biological. Case studies and Applications. The diversity and commonality of cells, protein structure and function, basic molecular genetic mechanisms, bio membranes and cell architecture, transport of ions and small molecules across Cell membranes, cellular energetics, cell birth, lineage and death.

**Self Study:** Physiological activities.

| UNIT 2 | Applications of Biology | 7 HOURS |
|---|---|---|

Physiologic Systems - An Outline of Cardiovascular Structure and Function, Endocrine System, Nervous System, Vision System, Defense mechanisms in plants and animals. Introduction to Bio Sensors, Performance Factors, Factors Affecting the Performance of Sensors, Areas of Application. Biological Sensing Elements, Biological transducers. Discovery and Innovations in applications of Biology. **Self Study:** Locomotion.

| UNIT 3 | The Role of Chemistry for Engineers | 8 HOURS |
|---|---|---|

**Applications/Case Study:** Hydrogen Spectrum.

(A) **Introduction:** This section is an introduction to chemistry and chemical methods for engineering students. It describes how chemistry is used in engineering and how chemical principles aid engineers in the choice of materials for a particular application. Principles of Green chemistry are reviewed. The classification of separation methods used for mixtures. (B) **Periodic Table:** This section covers the names and symbols of the elements. The basic structure of the atom is reviewed including an explanation of isotopes. A discussion of the atomic structure describes electronic shells, subshells, their quantum numbers, orbital shapes, electron filling order, and the determination of the complete electron configuration of the elements. General description of the modern periodic table. Correlation between the valence electron configurations and the chemical properties of the elements. The periodic trends according to the position of the elements in the periodic table.

**Self Study:** Slater's rule for ion.

| UNIT 4 | Chemical Bonding - The Formation of Materials | 9 HOURS |
|---|---|---|

(A) **The Formation of Materials:** This section covers chemical bonding and its effect on the chemical properties of the elements. Ionic bonding & covalent bonding are compared in terms of the octet rule and valence bond theory. Polar and non-polar covalent bonds. Molecular orbital theory is introduced to explain magnetism, bond order and hybridization helpful in Carbon chemistry. Intermolecular forces, including hydrogen bonding, are discussed with a special Case Study focusing on the special properties of water.

(B) **Engineering Materials:** This section covers the Resources of Natural Materials, Introduction to Material Sciences viz. Polymers, Specialty polymers, Biomaterials, Nano materials and Smart materials with their examples and applications.

**Self Study:** Real life applications of smart materials.

| UNIT 5 | Chemical Analysis and Instrumentation | 7 HOURS |
|---|---|---|

This chapter covers some of the more common instrumental methods used for the qualitative and quantitative analysis of materials. The principles of chromatography are introduced with paper chromatography and later applied to thin layer chromatography, pH-metry and Conductometry are reviewed as a few important and basic methods for analysis of chemical compounds and a case study on the analysis of water samples is given as an example. UV-visible absorption spectroscopy is reviewed as one of the sophisticated analytical techniques.

**Self Study:** Applications in Bio-medical field.

| UNIT 6 | Water Treatment and Effluent Management | 6 HOURS |
|---|---|---|

**Applications/Case Study:** Water analysis of river Indrayani.

This chapter covers types of impurities in water & the conventional water treatment methods. Hardness, Alkalinity and Chloride content of water, its causes, types and volumetric methods for their determinations are reviewed along with numerical. Various water softening & treatment methods which includes filtration methods by Carbon adsorption, ion-exchange methods and membrane techniques are explained.

## TEXT BOOKS


1. Jain, P. C., & Jain, M. (1998). Engineering Chemistry: Chemistry of Engineering Materials. Dhanpat Rai Pub. Com.
2. Khopkar, S. M. (2008). Basic of Concept of Analytical Chemistry; 3 rd Edn; New AGF International Pvt. Ltd. Publisher, New Delhi, 1-5.
3. Chauhan, B. S. (2008). Engineering Chemistry. Laxmi Publications, Ltd..
4. Lodish, H., Berk, A., Kaiser, C. A., Kaiser, C., Krieger, M., Scott, M. P., ... & Matsudaira, P. (2008). Molecular cell biology. Macmillan.


## REFERENCE BOOKS


1. Gaffney, J., & Marley, N. (2017). General chemistry for engineers. Elsevier.
2. Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2013). Fundamentals of analytical chemistry. Cengage learning.
3. Willard, H. H., Merritt Jr, L. L., Dean, J. A., & Settle Jr, F. A. (1988). Instrumental methods of analysis.
4. Pradeep, T. (2012). Textbook of nanoscience and nanotechnology. McGraw-Hill Education.


## E-RESOURCES

1. https://www.youtube.com/playlist?list=PLQz881uBQ2VolnNFyTQVpy4YVqUfnbvUw

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF CHEMICAL ENGINEERING | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Science of Nature Lab |
| | COURSE CODE | 2301104L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2301104L.CEO.1: To provide students with knowledge of purification and separation methods to evaluate their significance and applications in engineering.

2301104L.CEO.2: To enable students to understand chemical bonding and material science principles for assessing material properties and applications in engineering.

2301104L.CEO.3: To introduce students to basic principles and instrumentation techniques for performing and interpreting engineering-related analytical procedures.

2301104L.CEO.4: To educate students on water analysis techniques to enhance water quality for industrial use and meet environmental standards.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301104L.CO.1: Utilize the knowledge of purification and separation techniques to evaluate their significance and application in engineering contexts [L3].

2301104L.CO.2: Implement chemical bonding theories and engineering material principles to assess the formation and properties of materials for their practical use in engineering solutions [L3].

2301104L.CO.3: Employ the basic principles and instrumentation techniques to perform and interpret analytical techniques relevant to engineering [L3].

2301104L.CO.4: Apply methods for water analysis required for purification to enhance water quality, with a focus on industrial applications and compliance with environmental standards [L3].

## COURSE ABSTRACT

The fundamental objective of the Science of Nature course is to provide the extended knowledge of chemistry & biology required for engineering courses. The course defines the role of chemistry for engineers via topics like atomic structure & green chemistry principles. A few topics like Formation of Materials which covers chemical bonding and their influence on chemical properties & Engineering materials are included. This enables students to understand the application of chemistry in electronic gadgets, in construction, chemical compounds as a conducting materials, as smart materials, as nano materials viz carbon nano materials etc. Further, the analysis part involves various instrumental methods. It is aimed to give information about the advanced characterization and separation techniques of chemical compounds. The biology part of the course includes phenomena observed in nature viz., Physical, Chemical and Biological along with the case studies and applications. This gives much needed information about natural biological processes and their technical aspects in view of optimizing Engineering solutions. This promotes the applicability of engineering in understanding of chemistry/biology and visa-versa.

| **PRACTICALS:** Any 8 Experiments will be conducted. | | |
|---|---|---|
| **PRACTICAL NO.01** | **Distillation** | **2 HOURS** |
| Separation of two miscible liquids using distillation process. | | |
| **PRACTICAL NO.02** | **Polymerization** | **2 HOURS** |
| Synthesis by condensation polymerization reaction. | | |
| **PRACTICAL NO.03** | **Nano Particle** | **4 HOURS** |
| Synthesis of nano particles using reduction method. | | |
| **PRACTICAL NO.04** | **pH Metry** | **4 HOURS** |
| Determination of the dissociation constant of a weak acid using pH meter. | | |
| **PRACTICAL NO.05** | **Paper Chromatography** | **2 HOURS** |
| Separation of inorganic cations by paper chromatography. | | |
| **PRACTICAL NO.06** | **TLC** | **2 HOURS** |
| Separation of organic compounds by TLC. | | |
| **PRACTICAL NO.07** | **Conductometry** | **4 HOURS** |
| Conductometric titration for mixture of acids. | | |
| **PRACTICAL NO.08** | **Colorimetry / Spectrophotometry** | **2 HOURS** |
| Absorption studies. | | |
| **PRACTICAL NO.09** | **Hardness of Water** | **4 HOURS** |
| Determination of Hardness of water by EDTA method. | | |
| **PRACTICAL NO.10** | **Alkalinity** | **2 HOURS** |
| Determination of alkalinity of water by neutralization titration. | | |
| **PRACTICAL NO.11** | **Adsorption Studies** | **2 HOURS** |
| Water purification by activated charcoal. | | |
| **PRACTICAL NO.12** | **Physical Phenomenon** | **2 HOURS** |
| Case Studies of Physical Phenomenon | | |
| **PRACTICAL NO.13** | **Chemical Phenomenon** | **2 HOURS** |
| Case Studies of Chemical Phenomenon | | |
| **PRACTICAL NO.14** | **Biological Phenomenon** | **2 HOURS** |
| Case Studies of Biological Phenomenon | | |

## TEXT BOOKS


1. Jain, P. C., & Jain, M. (1998). Engineering Chemistry: Chemistry of Engineering Materials. Dhanpat Rai Pub. Com.
2. Khopkar, S. M. (2008). Basic of Concept of Analytical Chemistry; 3 rd Edn; New AGF International Pvt. Ltd. Publisher, New Delhi, 1-5.
3. Chauhan, B. S. (2008). Engineering Chemistry. Laxmi Publications, Ltd..
4. Lodish, H., Berk, A., Kaiser, C. A., Kaiser, C., Krieger, M., Scott, M. P., ... & Matsudaira, P. (2008). Molecular cell biology. Macmillan.


## REFERENCE BOOKS


1. Gaffney, J., & Marley, N. (2017). General chemistry for engineers. Elsevier.
2. Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2013). Fundamentals of analytical chemistry. Cengage learning.
3. Willard, H. H., Merritt Jr, L. L., Dean, J. A., & Settle Jr, F. A. (1988). Instrumental methods of analysis.
4. Pradeep, T. (2012). Textbook of nanoscience and nanotechnology. McGraw-Hill Education.


## E-RESOURCES

1. https://www.youtube.com/playlist?list=PLQz881uBQ2VolnNFyTQVpy4YVqUfnbvUw

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Foundation of Computing |
| | COURSE CODE | 2304101T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** Basics of Computer and Mathematics

## COURSE OBJECTIVES :

2304101T.CEO.1: Enhance problem solving abilities of students.

2304101T.CEO.2: Develop a logic to efficiently use the programming constructs to solve the computing problems.

2304101T.CEO.3: Encourage the test driven coding approach.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2304101T.CO.1: Design a solution to the problem by applying appropriate logic to get the desired results.[L3]

2304101T.CO.2: Design an algorithm and flowchart for the problem using traditional and tool-based approaches.[L3]

2304101T.CO.3: Solve the real world problems by multiple programming solutions.[L3]

**COURSE ABSTRACT:**

The Course emphasizes logic building and problem-solving abilities to write efficient algorithms and understanding how to debug and test C programs. C is the best programming language to start learning in computer programming. The significance of the C programming language is that it is recognized worldwide and used in many of the applications, including advanced scientific systems and operating systems. The C language provides the base language of all advanced computer languages. Course contains basic elements of C programming,data types, operators, Control Structures, conditional statements, looping , arrays, string operations, functions, pointers,user defined data types-structure and union.

**THEORY COURSE CONTENTS**

| UNIT 1 | FUNDAMENTALS OF C | 04 HOURS |
|---|---|---|

**Applications/Case Study:** Introduction to SCRATCH tool, Gaming applications, calculator application

**Contents:** Introduction to programming, why to learn programming, programming for everybody, Overview of C, Character set, Constants, Variables and Keywords, Data types, Operators - arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operator, Expressions- Type Conversion, precedence and order of evaluation

**Self Study:** Using conditions and loops on SCRATCH

| UNIT 2 | CONTROL STRUCTURES | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Ticket Booking App, online shopping site

**Contents:** Decision Control Structure-If statement, if-else statement, Nested if-else statement, Ternary operator, Case Control structure- Switch Case Statements, GOTO statement, Loop Control Structure- while statement, do while statement, for statement, odd loop, nesting of loops, break and continue statement, finite and infinite Loop

**Self Study:**Prepare Algorithm and Flowchart for the control statements above

| UNIT 3 | ARRAYS, STRINGS, FUNCTIONS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Leader Board of a game, Spell Checkers,Search Engine

**Contents:** Array Declaration and Initialization, Bounds Checking, Array arithmetic, One dimensional arrays and multi-dimensional Arrays, Strings - Standard Library String Functions, Array of strings, String operations, Functions, procedures, Difference between functions and procedures, Function definition and prototype, Scope Rule of Functions, Calling Conventions, Passing Values between Functions - Call by Values, Recursive functions, Passing Array Elements to a Function

**Self Study:** How to pass 2D array as a function parameter, Variable Length Arrays (VLAs) in C

| UNIT 4 | POINTERS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Dynamic Memory Allocation, Implementation of Data Structures

**Contents:** Pointers and Addresses, Pointer Notation and Arithmetic, Pointer to an array, Array of pointers, Pointer to a function, Passing pointers as function arguments, function call by reference, difference between call by value and call by reference, Strings and Pointers, Structures and Pointers

**Self Study:** Pointer to Pointer (Double Pointer), Chain of Pointers in C

| UNIT 5 | USER DEFINED DATA TYPES | 04 HOURS |
|---|---|---|

**Applications/Case Study:** Memory management, Database Management

**Contents:** Structures and Union: Declaration of Structure and Union, Difference between Structure and Union, Accessing Structure Elements, How Structure Elements are Stored, Array of Structures

**Self Study:** Anonymous Union and Structure in C, Enumeration (enum) in C

**Further Readings:** User Defined Data Type- class in CPP

## TEXT BOOKS


1. E. Balguruswamy , "Computing Fundamentals and C Programming" , Tata Mc-Graw Hill, ISBN 13: 978-0-07-066909-3
2. Balagurusamy, E. (2016). Programming In Ansi C.
3. Kanetkar, Y. (2018). Let us C. BPB publications.
4. Yashavant, K. (2020). Let us C. BPB Publications.
5. Kernighan, B. W., & Ritchie, D. M. (2002). The C programming language.
6. GHOSH, S. (2008). All of C. PHI Learning Pvt. Ltd.


## REFERENCE BOOKS


1. Hanly, J. R., & Koffman, E. B. (2007). Problem solving and program design in C. Pearson Education India.
2. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, Oxford University Press, ISBN 13 978-0-19-806528-9
3. S. Thamrai Selvi, R Murugesan, "Test your skills in C", Tata Mcgraw Hill, ISBN13:978-0-07-044759-2
4. Yashvant Kanitkar, "C Projects", BPB Publication, 2nd Edition, ISBN 81-7029-256-5
5. R.G. Dromey , "How to solve it by Computer", Prentice Hall, ISBN -13. 978-0134340012
6. Byron S. Gottfried, Jitender Kumar Chhabra, "Programming with C", Tata Mcgraw Hill, ISBN13:978-0- 07-059369-5


## E-RESOURCES

1. https://nptel.ac.in/courses/106105171
2. https://www.geeksforgeeks.org/c-programming-language/
3. https://www.w3schools.com/c/
4. https://www.codechef.com/ide
5. https://scratch.mit.edu/
6. https://www.youtube.com/@bhagyashreealhat4824/videos

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Foundations of Computing Lab |
| | COURSE CODE | 2304101L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 02 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Basics of Computer and Mathematics

## COURSE OBJECTIVES :

2304101L.CEO.1: Facilitate the building of programming solutions using the appropriate programming constructs.

2304101L.CEO.2: Encourage logical thinking to find alternate programming solution for the given problem.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2304101L.CO.1: Make use of appropriate programming constructs to solve real world problems. [L3]

2304101L.CO.2: Build modular, reusable code using functions, recursions and standard library functions. [L3]

2304101L.CO.3: Build a programming solution with suitable logic to get the required output.[L3]

**COURSE ABSTRACT:**

The Foundation of Computing Lab is a hands-on course designed to complement the theoretical knowledge of C programming with practical experience. This lab course aims to develop a deep understanding of the C language through a series of lab assignments, home assignments and real-world problem-solving scenarios. Students will learn the fundamentals of programming in C, including data types, control structures, functions, arrays, pointers.Emphasis is placed on writing optimized, readable, and error-free code via test driven approach.

**PRACTICALS**

| **PRACTICAL NO.01** | **Fundamentals of C** | **4 HOURS** |
|---|---|---|

**Practice Problem Statements:**

1. * Write a menu driven program in C to display addition, subtraction, multiplication, division of two numbers
2. Write a program in C to display the quotient and remainder after the division of two numbers
3. Write a program to evaluate any mathematical expression and observe the operator precedence
4. Write a program in C to demonstrate the use of left shift, right shift, and, or, xor operators

**Assignment:**

1. Write a program in C to demonstrate logical and relational operators

| **PRACTICAL NO.02** | **Control Structures** | **6 HOURS** |
|---|---|---|

**Practice Problem Statements:**

1. * Write a program in C to display the grade obtained by the student in a course. The input will be the marks obtained and the output will be the grade obtained
2. * Write a program in C to display first N numbers on the screen using while, do while and for loop
3. * Write a program in C to display first N number in reverse order on the screen using while, do while and for loop
4. * Write a program in C display various patterns using * ( Any two Patterns)
5. Get the information of lengths of sides and angles of triangle and print the type of triangle whether it is equilateral, isosceles or scalene, right, acute or obtuse.

**Assignment:**

1. Prepare a grocery bill after applying 5% discount for new customer and 10% discount for regular customer

| PRACTICAL NO.03 | Arrays, Strings and Functions | 8 HOURS |
|---|---|---|

**Practice Problem Statements:**

1. * Write a program in C to perform matrix addition
2. * Write a program in C to implement linear search and binary search algorithms for a numeric array
3. * Write a program in C to convert every lowercase letter to uppercase letter and vice versa
4. * Write a program in C to implement the string functions using the standard library functions supported by string.h like: string length, string copy, string reverse, string concatenate, string compare, sub string
5. Write a program in C to perform matrix multiplication
6. Take three different arrays to store numbers divisible by 2, 3 and 5 respectively. Get 20 numbers as input and place them in appropriate array
7. Write a C function to find simple interest. Pass input values as parameters
8. Write a program in C using recursion to display the Fibonacci sequence for a given range

**Assignment:**

1. Write a menu driven program in C using functions to implement the following string operations without using the standard library functions, string concatenate, string compare, string palindrome

| PRACTICAL NO.04 | Pointers | 8 HOURS |
|---|---|---|

**Practice Problem Statements:**

1. * Write a program to differentiate between pointer to an integer and pointer to an array of integers
2. * Write a program to print addresses of array elements using pointers
3. * Write a C function to swap values of two variables using call by reference
4. * Write a program to store and access string using pointer to string
5. Print numbers within given range by passing the function pointer as a parameter
6. Demonstrate working of circular linked list using pointers

| PRACTICAL NO.05 | User Defined Data Types | 2 HOURS |
|---|---|---|

**Practice Problem Statements:**

1. * Write a program in C to accept the information of five students and store it in structure and display the same
2. Write a C program using structure to store employee data (Name and salary) , then display name of the manager who is having highest salary, and obtain total expenditure of company on employee's salary

**Assignment(Any one):**

1. Use structure and pointers to maintain Olympic game's data. Store the information of medals won by several countries. Depending upon the types of medals won by the respective country give the rank
2. Use structure and pointers to maintain books data. Depending upon the number of readers of a book measure the popularity of that book

| PRACTICAL NO.06 | Competitive Coding | 4 HOURS |
|---|---|---|

* Solve scenario based real world problems by developing a solution in series of steps such as designing algorithms, data structures, coding/programming and testing.
Note: Practice Multiple Problems

**TEXT BOOKS**


1. E. Balguruswamy , "Computing Fundamentals and C Programming" , Tata Mc-Graw Hill, ISBN 13: 978-0-07-066909-3
2. Balagurusamy, E. (2016). Programming In Ansi C.
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5. Kernighan, B. W., & Ritchie, D. M. (2002). The C programming language.
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## REFERENCE BOOKS


1. Hanly, J. R., & Koffman, E. B. (2007). Problem solving and program design in C. Pearson Education India.
2. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, Oxford University Press, ISBN 13 978-0-19-806528-9
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4. Yashvant Kanitkar, "C Projects", BPB Publication, 2nd Edition, ISBN 81-7029-256-5
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6. Byron S. Gottfried, Jitender Kumar Chhabra, "Programming with C", Tata Mcgraw Hill, ISBN13:978-0- 07-059369-5


## E-RESOURCES

1. https://nptel.ac.in/courses/106105171
2. https://www.geeksforgeeks.org/c-programming-language/
3. https://www.w3schools.com/c/
4. https://www.codechef.com/ide
5. https://scratch.mit.edu/
6. https://www.youtube.com/@bhagyashreealhat4824/videos

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF CIVIL ENGINEERING | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Applied Mechanics |
| | COURSE CODE | 2303101T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2303101T.CEO.1: To define fundamental concepts and laws of rigid body mechanics.
2303101T.CEO.2: To state conditions of equilibrium for engineering structures.
2303101T.CEO.3: To describe kinematic parameters of rectilinear and curvilinear motion.
2303101T.CEO.4: To explain energy and momentum methods of kinetics"

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2303101T.CO.1: Determine the resultant of system of forces acting on bodies. [L1]
2303101T.CO.2: Calculate the support reactions and member forces for simple structures. [L2]
2303101T.CO.3: Analyse bodies in rectilinear and curvilinear motion. [L4]
2303101T.CO.4: Apply energy and momentum methods for kinetics problems. [L3]

## COURSE ABSTRACT

This course is built on the foundation and framework of mathematics and physics. The course requires students to have strong abstract thinking and reasoning skills. In addition, Concepts will be applied in this course from previous courses you have taken in basic math and physics. The course addresses the modeling and analysis of real world engineering applications and problem solving. In this course, we shall be learning about interaction between bodies dealing with STATICS and in the second part DYNAMICS students will study the motion of particles. Statics covers free body diagrams, equilibrium of rigid bodies, analysis of trusses and beams, discussion on friction, virtual work and stability. Dynamics deals with general plane motion of rigid bodies, use of translating and rotating motion frames of reference for analysis, plane kinetics and work energy principle.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Basics of Statics** | **7 HOURS** |

**Applications/Case Study:** Failure of any building, bridge etc.

**Contents:** Fundamental Concepts and Principles in mechanics, Force and force systems, Resolution, Resultant, and Moment of a force system; Equilibrium of a particle systems. Free body diagram (FBD). Equilibrium of rigid bodies.

**Self Study:** Observe the static objects around you and draw free body diagram and calculate resultant of same.

| | | |
|---|---|---|
| **UNIT 2** | **Applications of Statics** | **8 HOURS** |

**Applications/Case Study:** Determination of axial forces for industrial truss.

**Contents:** Types of supports and their reactions. Beam reactions, Analysis of cables, Analysis of trusses, and Analysis of frames. Centroid of plane laminas. Engineering applications of friction. Belt Friction, Wedge friction.

**Self Study:** Understanding following questions are expected from the students.

1. What does it mean for a design of members to be ”Statically indeterminable”?
2. What is a ”Two force Member”?
3. Which forces are allowed on a member?

| | | |
|---|---|---|
| **UNIT 3** | **Kinematics of particle** | **8 HOURS** |

**Applications/Case Study:** Falling Body and Projectile Motion Case Study.

**Contents:** Basic concepts in kinematics- Position, velocity, acceleration, jerk. Rectilinear motion with constant and variable acceleration. Connected body motions. Relative motion. Curvilinear motion in Cartesian coordinates and path coordinates.

**Self Study:** Study of gyroscopic motion.

| UNIT 4 | Kinetics of particle | 7 HOURS |
|---|---|---|

**Contents:** Kinetics- Equation of motion. Concept of work done, energy and power. Principle of work and energy. Conservation of energy. Principle of impulse and momentum. Conservation of momentum. Collisions- Direct central impact. Coefficient of restitution.

**Self Study:** Study of vehicle dynamics.

## TEXT BOOKS


1. Nelason, A. (2009). Engineering Mechanics: Statics and Dynamics. 2nd Edition, Tata McGraw-Hill Education.
2. Anil Kumar D. (2015). Engineering Mechanics: Statics Dynamics", 1st edition, Tata McGraw-Hill Education.


## REFERENCE BOOKS


1. Hibbeler, R. C. (2009). Gupta Ashok Engineering Mechanics: Statics Dynamics.", 14th Edition, Pearson Education Inc., Prentice Hall.


## E-RESOURCES

1. https://archive.nptel.ac.in/courses/112/106/112106286/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF CIVIL ENGINEERING** | **W.E.F** | |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Applied Mechanics |
| | **COURSE CODE** | 2303101L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2303101L.CEO.1: To provide students with hands-on experience and practical knowledge in the field of applied mechanics.

2303101L.CEO.2: To bridge the gap between theoretical concepts learned in the classroom and real-world applications.

2303101L.CEO.3: To develop a deep understanding of fundamental mechanics principles and their practical implications.through a combination of experiments and projects,"

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2303101L.CO.1: Develop a practical understanding of fundamental mechanics principles and apply theoretical knowledge to solve real-world engineering problems [L3].

2303101L.CO.2: Analyze, and interpret experimental data, and present results in a clear and organized manner [L4].

2303101L.CO.3: Design, conduct, and analyze experiments by effective collbrating with team members [L6].

2303101L.CO.4: Build ethical behavior in conducting experiments, handling data, and interacting with colleagues [L3]. "

## COURSE ABSTRACT

The Applied Mechanics Laboratory serves as a crucial platform for understanding fundamental prin- ciples and practical applications of mechanics in engineering. This abstract provides an overview of the objectives, methodologies, and potential outcomes of experiments conducted within this laboratory setting.The primary goal of the Applied Mechanics Laboratory is to provide students with hands-on experience in exploring and analyzing various mechanical phenomena. Through a series of carefully designed experiments, participants gain insights into the behavior of materials and structures under different loading conditions. The laboratory covers a diverse range of topics, including statics and dynamics.Experiments within the laboratory involve the use of state-of-the-art equipment and measurement tools to investigate the mechanical characteristics of materials such as metals, polymers, and composites. Static experiments focus on equilibrium conditions and the study of forces and moments, while dynamic experiments explore the dynamic response of structures to external forces.

| PRACTICALS/ACTIVITIES | | |
|---|---|---|
| **PRACTICAL NO.01** | **Parallelogram Law** | **2 HOURS** |
| To verify parallelogram law of force addition. | | |
| **PRACTICAL NO.02** | **Law of moments** | **2 HOURS** |
| To verify law of moments for parallel forces. | | |
| **PRACTICAL NO.03** | **Block Friction** | **2 HOURS** |
| To determine coefficient of static friction for a block on a plane. | | |
| **ACTIVITY NO.01** | **Truss model** | **2 HOURS** |
| To develop truss model. | | |
| **PRACTICAL NO.04** | **Belt Friction** | **2 HOURS** |
| To determine coefficient of static friction for a flat belt on a drum. | | |
| **PRACTICAL NO.05** | **Centroid 1D** | **2 HOURS** |
| To determine centroid of composite wire object. | | |
| **PRACTICAL NO.06** | **Centroid 2D** | **2 HOURS** |
| To determine centroid of composite plane lamina. | | |
| **ACTIVITY NO.02** | **Model making for Centroid** | **2 HOURS** |
| To develop the model for centroid. | | |
| **PRACTICAL NO.07** | **Projectile Motion** | **2 HOURS** |
| To analyze projectile motion in Cartesian coordinates. | | |
| **ACTIVITY NO.03** | **Model making for Projectile** | **2 HOURS** |
| To develop the model for projectile. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.08** | **Compound Pendulum** | **2 HOURS** |
| To determine mass moment of Inertia of compound pendulum. | | |
| **PRACTICAL NO.09** | **Fly Wheel** | **2 HOURS** |
| To analyse rotational motion of a flywheel about a fixed axis. | | |
| **ACTIVITY NO.04** | **Model of parachute** | **2 HOURS** |
| To develop the parachute model. | | |
| **PRACTICAL NO.10** | **Direct Central Impact** | **2 HOURS** |
| To determine coefficient of restitution for direct central impact. | | |
| **PRACTICAL NO.11** | **Final Exam** | **2 HOURS** |
| For all batches during the lab hours. | | |

## TEXT BOOKS


1. Meriam, J. L., Kraige, L. G., & Bolton, J. N. (2020). Engineering mechanics: dynamics. John Wiley & Sons.


## REFERENCE BOOKS

1. NIL

## E-RESOURCES

1. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF MECHANICAL ENGINEERING | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Design Thinking |
| | COURSE CODE | 2309101T |
| | COURSE CREDITS | 1 |
| RELEASED DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

**PRE-REQUISITE :** NIL

## COURSE OBJECTIVES :

2309101T.CEO.1: To utilize information collection tools to clearly define user centric problem.
2309101T.CEO.2: To apply SCAMPER tool to find diverse solutions.
2309101T.CEO.3: To choose one concept out of the selected alternatives by taking into consideration user centred design parameters.

## COURSE OUTCOMES:

The students after completion of the course will be able to,

2309101T.CO.1: Apply Design Thinking principle to user centric problem [L3].
2309101T.CO.2: Select different design thinking tools to solve real world problem [L3].
2309101T.CO.3: List appropriate prototyping technique to build a solution [L4].

## COURSE ABSTRACT

Design thinking is a powerful process of problem solving as it deals with human centred design approach. When design thinking approaches are applied to business, the success rate for innovation improves substantially. The course aim to imbibe understanding of the design thinking process and apply it to real-world problems while building their strong teamwork and communication skills. Students will learn to use the design thinking process to solve complex problems and create innovative solutions. Course covers topics such as research, ideation, prototyping, testing, and iteration. Students also learn to use a variety of design thinking tools, such as personas, journey maps, mind mapping, SWOT analysis, SCAMPER, Brainstorming, AEIOU framework etc. Students work in team to tackle real-world design challenges. So they learn how to communicate their ideas effectively and how to receive and give constructive feedback and present their design solutions in aclear and compelling manner. Upon completion of the course, students will have a deep understanding of the design thinking process and how to apply it to real- world problems. They will be able to use a variety of design thinking tools and techniques to generate and evaluate ideas, create prototypes, and test and refine their solutions. They will also have strong teamwork and communication skills, making them valuable members of any design team.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **FUNDAMENTALS OF DESIGN THINKING** | **2 HOURS** |

Introduction to design, types of design, Introduction to Design Thinking, Divergent Thinking, Convergent Thinking.

Various types of thinking: Critical thinking, Creative thinking, lateral thinking, Disruptive Thinking.

**Self Study:** Timeline.

| | | |
|---|---|---|
| **UNIT 2** | **HUMAN CENTRED DESIGN** | **2 HOURS** |

Introduction to Human Centred Design, Human Centred Design Phases, Human Centred Design Process, Human Centred Design case study, Planet centric Design.

**Self Study:** Customer Journey Map.

| | | |
|---|---|---|
| **UNIT 3** | **ANTHROPOLOGY** | **2 HOURS** |

Characteristics of Anthropology: Culture, holistic approach, field work, multiple theories and purposes of anthropology. Empathy and Ethnography.

**Self Study-** Ethnograpy: AEIOU Framework.

| | | |
|---|---|---|
| **UNIT 4** | **DESIGN THINKING TOOLS** | **3 HOURS** |

Empathy stage tools : User Research Tools (Interviews: Conducting one-on-one or group interviews to get deep insights into user behavior and needs, Surveys & Questionnaires, Ethnographic Studies, Observation), Empathy Map, Personas Define stage tools: Problem Statement/Point of View (POV), Affinity Diagrams, Journey Mapping Ideate Stage Tools: Brainstorming, Mind Mapping, SCAMPER Prototype Stage Tools: Low-Fidelity Prototypes, High-Fidelity Prototypes, Storyboarding, Wizard of Oz Prototyping

**Self Study:** Likert Scale, Affinity Diagram, Reverse engineering of a research paper to identify all the essential elements of the research.

| UNIT 5 | IDEATION | 4 HOURS |
|---|---|---|
| SWOT analysis, Vein Diagram (User Desirability, Feasibility, Viability check) Drawing inferences, Translation of inferences into design criteria, specific problem statement, Ideation – free hand sketching drawing of simple form of products (Isometric views, layout, circuit diagram, Ideation sketches), Ergonomic and aesthetic consideration in design.<br>**Case Study:** SCAMPER, TRIZ. | | |
| **UNIT 6** | **PROTOTYPING** | **2 HOURS** |
| Concept validation, evaluation and detailing, Different methods of Prototyping, selection of right method of prototyping.<br>**Case Study:** Minimum Viable Product. | | |

## TEXT BOOKS


1. Yayici, E. (2016). Design thinking methodology book. ArtBizTech.
2. Mootee, I. (2013). Design thinking for strategic innovation: What they can't teach you at business or design school. John Wiley & Sons.
3. Lockwood, T. (2010). Design thinking: Integrating innovation, customer experience, and brand value. Simon and Schuster.
4. Marc, S. (2012). This is Service Design Thinking: Basics-Tools-Cases. Bis Publishers.


## REFERENCE BOOKS


1. Jones, J. C. (1992). Design methods. John Wiley & Sons.
2. Cross, N. (2011). Design thinking: Understanding how designers think and work. Berg.
3. Gonen, E. (2020). Tim brown, change by design: how design thinking transforms organizations and inspires innovation (2009). Markets, Globalization & Development Review, 4(2).
4. Melles, G., de Vere, I., & Misic, V. (2011). Socially responsible design: thinking beyond the triple bottom line to socially responsive and sustainable product design. CoDesign, 7(3-4), 143-154.
5. Kumar, V. (2012). 101 design methods: A structured approach for driving innovation in your organization. John Wiley & Sons.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF MECHANICAL ENGINEERING | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Design Thinking Lab |
| | COURSE CODE | 2309101L |
| | COURSE CREDITS | 1 |
| RELEASED DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 20 | 40 |

**PRE-REQUISITE :** NIL

## COURSE OBJECTIVES :

2309101L.CEO.1: To apply ethnographic framework to carryout design thinking project.
2309101L.CEO.2: To build prototype of alternative based on human centred design.
2309101L.CEO.3: To present design thinking project.

## COURSE OUTCOMES:

The students after completion of the course will be able to,

2309101L.CO.1: To apply ethnographic framework to define design thinking project [L3].
2309101L.CO.2: Identify the specific problem of target user [L3].
2309101L.CO.3: Develop multiple solution for the identified problem [L3].
2309101L.CO.4: Build the prototype of the best fitted solution [L3].
2309101L.CO.5: Conduct test for validation of the best fitted solution [L4].

## COURSE ABSTRACT

In Design thinking lab students will carry out all the steps involved in design thinking practically. The steps involved are empathy, problem definition, ideation, prototyping and testing. Students will engage in observing and understanding user needs within a specific domain. They will carry out primary and secondary research to gather relevant data and insights (empathy map and problem definition). This research will help students to define the specifications and requirements for the product. Using SCAMPER tool students will generate innovative ideas based on the identified needs and specifications (ideation). Evaluation of concepts will be carried out by using Pugh matrix and the concept which is having more weightage will be selected for creating a prototype (concept evaluation and testing). Using this prototype student will validate the solution by taking feedback from user(testing). In summary student will apply the tools taught during theory class to carry out their design thinking project.

| **PRACTICALS:(Project Work)** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Needs Finding (Observation of Domain)<br>**Self Study:** space Interaction. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Research methodology | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Product Specification<br>**Self Study:** RUTAG Project Exploration. | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Ideation | | |
| **PRACTICAL NO.05** | | **4 HOURS** |
| Concept Evaluation, Validation and Concept detailing<br>**Self Study:** Pugh Matrix. | | |
| **PRACTICAL NO.06** | | **6 HOURS** |
| Prototyping | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Documentation | | |

## TEXT BOOKS


1. Yayici, E. (2016). Design thinking methodology book. ArtBizTech.
2. Mootee, I. (2013). Design thinking for strategic innovation: What they can't teach you at business or design school. John Wiley & Sons.
3. Lockwood, T. (2010). Design thinking: Integrating innovation, customer experience, and brand value. Simon and Schuster.
4. Marc, S. (2012). This is Service Design Thinking: Basics-Tools-Cases. Bis Publishers.


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1. Jones, J. C. (1992). Design methods. John Wiley & Sons.
2. Cross, N. (2011). Design thinking: Understanding how designers think and work. Berg.
3. Gonen, E. (2020). Tim brown, change by design: how design thinking transforms organizations and inspires innovation (2009). Markets, Globalization & Development Review, 4(2).
4. Melles, G., de Vere, I., & Misic, V. (2011). Socially responsible design: thinking beyond the triple bottom line to socially responsive and sustainable product design. CoDesign, 7(3-4), 143-154.
5. Kumar, V. (2012). 101 design methods: A structured approach for driving innovation in your organization. John Wiley & Sons.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY (IT) | COURSE NAME | Data Driven Modeling |
| | COURSE CODE | 2308161T |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

**PREREQUISITE KNOWLEDGE :** NIL

**COURSE OBJECTIVES :**

2308161T.CEO.1: Understand the need of data modeling.
2308161T.CEO.2: Learn different types of data modeling.
2308161T.CEO.3: Analyzing data for better decision making.
2308161T.CEO.4: Optimize the querying for effective data analysis.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2308161T.CO.1: Able to make a Dimensional table with facts and measures. [L3].
2308161T.CO.2: Select correct dimensional model for the given case study [L4].
2308161T.CO.3: Apply Data definition, control and manipulation queries on given data [L3].
2308161T.CO.4: Use joins and subqueries for data analysis [L3].

**COURSE ABSTRACT:**

This course is designed to give a primer in the fundamentals of data modeling and querying techniques for better decision making. Effective use of SQL and working with data for data driven decision making. As data driven decision making is a need of hour, it is important to learn how to use and apply the powerful language of SQL to better communicate and extract data from databases in the data science field. Acquiring skills of SQL for Data Science is one of the fastest ways to improve the career prospects of the students as it is one of the most in-demand tech skills! This course will imbibe basic to moderate analysis techniques using querying methods. This course will teach students to ask the right questions and come up with good answers to deliver valuable insights for the organization. This course starts with the basics and assumes students do not have any knowledge or skills in data modeling and SQL. It will build on that foundation and gradually make students competent to write both simple and complex queries to gain better insights.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION** | **06 HOURS** |
| **Applications/Case Study:** NIL<br>**Contents:** Introduction to data management, different types of data management schemes, Relational data management , Significance of data management. Concepts of primary and foreign keys.<br>**Self Study:** Properties of good database<br>**Further Readings:** Relational key mappings | | |
| **UNIT 2** | **DATA MODELING** | **05 HOURS** |
| **Applications/Case Study:** NIL<br>**Contents:** Need for data modeling, Different types of modeling techniques, case study for making start, snowflake and fact constellation modeling.<br>**Self Study:** Facts and Dimensions<br>**Further Readings:** Types of different dimensions and facts and it's significance | | |
| **UNIT 3** | **BASICS OF SQL** | **04 HOURS** |
| **Applications/Case Study:** NIL<br>**Contents:** Study of different Analyzing, transforming and summarizing methods using SQL queries.<br>**Self Study:** Different Domain Databases<br>**Further Readings:** Varrays and Object Oriented SQL | | |

## TEXT BOOKS


1. Allen G. Taylor. (2019). *SQL All - In - One For Dummies*. 3rd Edition, Wiley. ISBN 978-8126534494.
2. Berg Craig. (2019). *SQL For Beginners: SQL Made Easy; A Step-By-Step Guide to SQL Programming for the Beginner, Intermediate and Advanced User (Including Projects and Exercises)*. 1st Edition, Antony Mwau. ISBN 978-1951737252.
3. Jiawei Han, Micheline Kamber, Jian Pei. (2022). *Data Mining: Concepts and Techniques*. 4th Edition, Elsevier Standard. ISBN 978-8131267660.
4. Rick Sherman. (2014). *Business Intelligence Guidebook: From Data Integration to Analytics*. 4th Edition, The Morgan Kaufmann Series in Data Management Systems. ISBN 978-0124114616.
5. Sheldon Ross. (2017). *Introductory Statistics*. 4th Edition, Academic Press. ISBN 978-0128043172.


## REFERENCE BOOKS


1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan. (2021). *Database System Concepts* . 7th Edition, McGraw-Hill Education. ISBN 978-9390727506.
2. Paulraj Ponniah (2012). *Data Warehousing: Fundamentals for IT Professionals*. 2nd Edition, Paperback, McGraw Hill Publishers. ISBN 978-0073523323.
3. Ralph Kimball.(2009). *Data Warehouse Lifecycle Toolkit*. 2nd Edition, Willey. ISBN 978-0470149775.
4. Maria Sueli Almeida, Missao Ishikawa, Joerg Reinschmidt, Torsten Roeber.(1999). *Getting Started with Data Warehouse and Business Intelligence*. 2nd Edition, IBM Redbook. ISBN 978-0738413747.
5. Ramesh Sharda, DursunDelen, Efraim Turban.(2019). *Getting Started with Data Warehouse and Business Intelligence*. 4th Edition, Pearson Education. ISBN 978-9353067021.
6. Hadley Wickham, Mine Ç etinkaya-Rundel, Garrett Grolemund.(2023). *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*. 2nd Edition, O'Reilly. ISBN 978-9355429827.
7. Murrey R Spiegal, Larry Stifens. *Statistics*. 5th Edition,Schaum's Series, McGraw-Hill Education. ISBN 978-0071822527.


## E-CONTENTS/VIRTUAL LAB/ONLINE SIMULATOR LINKS

1. https://www.w3schools.com/sql/default.asp

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY (IT) | COURSE NAME | Data Driven Modeling Lab |
| | COURSE CODE | 2308161L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** NIL

**COURSE OBJECTIVES :**

2308161L.CEO.1: Understand the need of data modeling.
2308161L.CEO.2: Learn different types of data modeling.
2308161L.CEO.3: Analyzing data for better decision making.
2308161L.CEO.4: Optimize the querying for effective data analysis.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2308161L.CO.1: Able to make a Dimensional table with facts and measures. [L3].
2308161L.CO.2: Select correct dimensional model for the given case study [L4].
2308161L.CO.3: Apply Data definition, control and manipulation queries on given data [L3].
2308161L.CO.4: Use joins and subqueries for data analysis [L3].

**COURSE ABSTRACT:**

This course is designed to give a primer in the fundamentals of data modeling and querying techniques for better decision making. Effective use of SQL and working with data for data driven decision making. As data driven decision making is a need of hour, it is important to learn how to use and apply the powerful language of SQL to better communicate and extract data from databases in the data science field. Acquiring skills of SQL for Data Science is one of the fastest ways to improve the career prospects of the students as it is one of the most in-demand tech skills! This course will imbibe basic to moderate analysis techniques using querying methods. This course will teach students to ask the right questions and come up with good answers to deliver valuable insights for the organization. This course starts with the basics and assumes students do not have any knowledge or skills in data modeling and SQL. It will build on that foundation and gradually make students competent to write both simple and complex queries to gain better insights.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **06 HOURS** |
| Dimensional model creation for given case study using DDL Queries with all constraints. | | |
| **PRACTICAL NO.02** | | **06 HOURS** |
| Data control, summarization and analysis using queries for given data model | | |
| **PRACTICAL NO.03** | | **06 HOURS** |
| User management, filtering and aggregation operations on given data model. | | |
| **PRACTICAL NO.04** | | **06 HOURS** |
| Performing joins and optimization for efficient data analysis for given case study | | |
| **PRACTICAL NO.05** | | **06 HOURS** |
| Accessing database using Python: In a Jupyter Notebook, create tables, load data, query data using SQL magic and SQLite python library. | | |

## TEXT BOOKS


1. Allen G. Taylor. (2019). *SQL All - In - One For Dummies*. 3rd Edition, Wiley. ISBN 978-8126534494.
2. Berg Craig. (2019). *SQL For Beginners: SQL Made Easy; A Step-By-Step Guide to SQL Programming for the Beginner, Intermediate and Advanced User (Including Projects and Exercises)*. 1st Edition, Antony Mwau. ISBN 978-1951737252.
3. Jiawei Han, Micheline Kamber, Jian Pei. (2022). *Data Mining: Concepts and Techniques*. 4th Edition, Elsevier Standard. ISBN 978-8131267660.
4. Rick Sherman. (2014). *Business Intelligence Guidebook: From Data Integration to Analytics*. 4th Edition, The Morgan Kaufmann Series in Data Management Systems. ISBN 978-0124114616.
5. Sheldon Ross. (2017). *Introductory Statistics*. 4th Edition, Academic Press. ISBN 978-0128043172.


## REFERENCE BOOKS


1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan. (2021). *Database System Concepts* . 7th Edition, McGraw-Hill Education. ISBN 978-9390727506.
2. Paulraj Ponniah (2012). *Data Warehousing: Fundamentals for IT Professionals*. 2nd Edition, Paperback, McGraw Hill Publishers. ISBN 978-0073523323.
3. Ralph Kimball.(2009). *Data Warehouse Lifecycle Toolkit*. 2nd Edition, Willey. ISBN 978-0470149775.
4. Maria Sueli Almeida, Missao Ishikawa, Joerg Reinschmidt, Torsten Roeber.(1999). *Getting Started with Data Warehouse and Business Intelligence*. 2nd Edition, IBM Redbook. ISBN 978-0738413747.
5. Ramesh Sharda, DursunDelen, Efraim Turban.(2019). *Getting Started with Data Warehouse and Business Intelligence*. 4th Edition, Pearson Education. ISBN 978-9353067021.
6. Hadley Wickham, Mine Ç etinkaya-Rundel, Garrett Grolemund.(2023). *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*. 2nd Edition, O'Reilly. ISBN 978-9355429827.
7. Murrey R Spiegal, Larry Stifens. *Statistics*. 5th Edition,Schaum's Series, McGraw-Hill Education. ISBN 978-0071822527.


## E-CONTENTS/VIRTUAL LAB/ONLINE SIMULATOR LINKS

1. https://www.w3schools.com/sql/default.asp

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Liberal Learning |
| | COURSE CODE | 2301182 |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

## COURSE OBJECTIVES :

2301182.CEO.1: Create a comprehensive understanding of diverse forms of expression that contribute to liberal education

2301182.CEO.2: Create a broad set of skills and perspectives for overall development and personal well being.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301182.CO.1: Develop proficiency in expressive arts, amateur interest for holistic development as a lifelong learning [L6].

2301182.CO.2: Teach personal and social well-being through mind-body practices for the cultivation of free human beings [L3].

## COURSE ABSTRACT

Liberal education is a learning approach that teaches students how to think independently and develop broad academic and intellectual abilities. It rests on a multidisciplinary and interdisciplinary approach. Education Policy, which had a revamp in 2020 has laid out a path for universities to adopt a liberal education, discussion based and discovery base mode of education. It encourages a multidisciplinary education system that helps develop the creative and analytical sides of the brain simultaneously. It inculcates transferable skill set, ability to apply knowledge to practical real-world situations, connecting the dots through various mental models, habits of self-reflection, contextual learning, freedom of the mind and lifelong learning. India needs a liberal education because to enhance Interdisciplinary and multidisciplinary approach to learning and Preparing students to become real-world person.

| THEORY COURSE CONTENTS: Students may select any one of the following tracks. | | |
|---|---|---|
| **Track 1** | **Chess** | **30 HOURS** |
| Introduction to game of Chess. Rules, movement of pieces, strengths and weaknesses of all pieces. Stalemate, touch move, etiquette, pawn promotion and zugzwang, square of the pawn. Fundamental checkmate patterns, basic rules, special moves and rules such as castling, promotion, EnPassant, good moves for the opening. | | |
| **Track 2** | **Kabaddi** | **30 HOURS** |
| Recent trends in kabaddi - History and Development. a) Different forms played - Zemini, Sanjeevani & Amar. b) Different chants (cant) - Hadu-Du, Chedu-Gudu, Hu-tutu & other forms. c) Played in different size playfields with different number of players. d) No uniform rules and regulations, Traditional Kabaddi, Modern Kabaddi. Kabaddi Pioneers: Raiders, Escaping tactics by raiders in different situation, Before starting of the raid strategies, during the raid strategy and tactics, Turning, Falling and sliding as tactics, Creating gap to escape . | | |
| **Track 3** | **Drama** | **30 HOURS** |
| Introduction to Acting, Introduction to Theatre Techniques and Design Theatre History, Literature and Aesthetics, basics of Acting, Theatre Techniques and Design, and Theatre History, Literature and Aesthetics. In the second semester the same subjects are studied in details. Specialisation in Acting, Theatre Techniques and Design Theatre History, Literature and Aesthetic. Theatre History, Literature and Aesthetics, Acting (specialisation). | | |
| **Track 4** | **Singing** | **30 HOURS** |
| Vocal cords, Voice types, Female: Soprano or alto, Male: Tenor, baritone or bass, Breathing Techniques, Role of breathing in singing, types of scales and pitches, Musical notes foundation of any song, Humming exercise, tongue twisters, vowels, Tempo of song, Tempo Markings, Practicing all octaves, analysis of songs, practicing songs. | | |

| Track 5 | Dance | 30 HOURS |
|---|---|---|
| History, mythological aspects, and their impact on the dance form, movements, pattern of beats, use of these forms, Basic knowledge of: basic Adavu steps, hand gestures 'Mudra', Nritta, nrittya and Natakas, Tala, Gati, postures, moods, feet movements, and stances. Introduction to Bollywood dance, Basic Bollywood combinations/choreography, Introduction of styles of Bollywood, Introduction of dance choreographies from classic and modern Bollywood films, influence and inclusion of western dance. History of street dance steps and styles and the pioneers and dance legends involved in their creation, Basic steps of Hip Hop dance, Learn foundations & routines within hip hop culture, Types of hip hop: contemporary hip hop, lyrical hip hop, etc. Dance history, Learning about warm ups, floor work, standing work, travelling work, articulation of limbs, turns and jumps etc. | | |
| **Track 6** | **Painting (Design)** | **30 HOURS** |
| Object Drawing / Still Life - Graphic sketching, mutual proportion of object groups, space joiner, shadow differentiation on objects, Sketching and painting of object groups Memory Drawing - observa- tion, memory and imagination, proportional sketching of incidents in daily life, closeness and distantness (perspective) in drawing. Design – creative expression, basic principles of design, effective use of colors and color shades, aesthetic sense and creation of utility through design, geometrical equipment and material, color mediums and techniques. Geometry, Solid Geometry and Lettering - Development of capability of use of geometrical constructions for creation of pattern, geometrical shapes and their construction. | | |
| **Track 7** | **Sculpture Design** | **30 HOURS** |
| The fundamental principles and techniques of sculpture, including the exploration of various materials and processes, sculptural skills and conceptual thinking. Introduction to sculpture, Brief history of sculpture, tools handling and techniques, material handling techniques, methods & applications – additive & subtractive, pinching method & slab method (application), concepts Development - perceive line as an edge, understanding fundamental elements & principles of sculpture tools handling and techniques, concept understanding. | | |
| **Track 8** | **Introduction to photography** | **30 HOURS** |
| Types of Lights, effect of Lights, Types of Lenses & their uses. Understanding the three main ingre- dients or elements or pillars of photography that work together: Aperture, Shutter Speed, and ISO. Understanding the concept of ISO sensitivity, in detail with hands-on session. Understanding the concept of Shutter Speed, effect of high & low shutter speed on photographs, with hands-on session. Concept of aperture, F-stop notations, effect of variation of aperture on images. Hands-on session. Compositional Rules like Rule of Thirds, Negative Space, Horizon Line, Golden ratio etc. Framing. Hands-on training. Difference between Auto focus & manual focus, Focusing the object manually, concept of depth of field with wide aperture lens. Hands-on. Framing in landscape photography, bird photography framing. Bokhe effect, Time lapse, multiple exposure, Silhouettes, Long exposure, Steel wool photography. | | |

| Track 9 | Yoga and Meditation | 30 HOURS |
|---|---|---|

Brief history and philosophy of Yoga, benefits of Yoga, Key techniques of Yoga. Introduction to dif- ferent types of Yoga, understanding the diversity of yoga practices and their origins, Yoga-Sutras, Limbs of Yoga. Introduction to Meditation, understanding the essence and benefits of meditation, introduction to different types and approaches to meditation, Meditation techniques for health pro- motion, Relaxation techniques. Overview of Postural alignment, importance of postures, Practices of various posture. Understanding the importance of a balanced diet for overall well-being, Principles of balanced nutrition, diet for preventive and curative aspects of health, Mind Power. Gentle warm-up and stretching, Introduction to seated forward bends and gentle backbends, Relaxation techniques: Guided progressive muscle relaxation. Introduction to breathing and its significance, understanding the role of breathing in overall well-being, importance of conscious breathing in stress reduction and relaxation. Yogic breathings techniques. Intended to various Asana, benefits of Asana. Introduc- tion to pranayama, pranayama techniques for health promotion practical sessions, difference between pranayama and deep breathing, Anuloma-viloma, Suryabhedana, Ujjayi, Bharmari, Bhastrika, Shitali and Shitkari Pranayama. Understanding of Mudras and Kriyas, Practical sessions .

| Track 10 | Spiritual Minds | 30 HOURS |
|---|---|---|

1.Spirituality -True meaning of Spirituality and explaining the hierarchy of Inner world, awareness about Existence of God.2.Yoga & Meditation- Explaining the Chakras and the Aura, various types of Mediations.3.Respect, Gratitude & Reverence -Explaining the meaning Respect, Gratitude & Rever- ence by giving the examples from Mahabharata and try to cultivate these qualities in the students.4.Low of Forgiveness and Low of KARMA-Explaining the deepest meaning of Law of forgiveness and Law of KARMA and make the student refrain from unwholesome actions and behaviors.5.Relationship- how to maintain and improve the relationship with Parents, friends, people around us and NATURE.6.Physical and Mental Health – how to improve Physical and Mental health with the help of circadian rhythm, mediation, Pranayamas and yogasanas. How to become more productive.7.Stress Management- dis- cuss the root cause of stress, types of Stress. Explain the techniques and remedies to overcome the Stress.8.Love Yourself – How to give quality time to 'yourself', how to make yourself anxiety free and find the real happiness within us.9.Let's Label jars and not people- how to refrain from to criticism and judgmental with the people around us.10.Goal setting- how to set goals in your life and how to achieve
those goals in a positive manner.

| Track 11 | Content Writing | 30 HOURS |
|---|---|---|

Introduction to Content Writing, Writing Fundamentals, Research skills, Blog Writing, Website Writ- ing, Role of SEO in Content Writing, Content Marketing Strategy, Portfolio Development & Career Opportunities, Branding (in copywriting point of view), Technical writing, UX/UI writing, AI in con- tent writing (ChatGPT).

| Track 12 | Digital Marketing | 30 HOURS |
|---|---|---|
| Basics digital marketing, analysis and keyword research, search engine optimization, on-page optimization, off-page optimization, SEO updates and analysis, local business and google mapping, google adwords or pay per click marketing (SEM), social media optimization, social media marketing, google web analytics, webmaster tools, creating a new simple website. Illustrating the dialog delivery, expres- sions, volume, pitch in the dialog, Expression through photography and editing skill with an expertise in handling cameras, microphone, effective management skill enabling the justification through foundation till representation. | | |
| **Track 13** | **Social Work** | **30 HOURS** |
| Importance of Empathy, Empathy and it's limits, Role of empathy and compassion for engineers, Empathy activities, Differences, Conservatives and Liberals, Disgust and Honor, Stereotypes, The Problem of Kindness, Skepticism About the Self, Free Will and the Situation, Recognizing emotions, reading body language, improving listening skills, mindful self-compassion, Compassionate Leadership, Origins of Morality, joy of giving, social responsibility, exercising social services. | | |
| **Track 14** | **Indian Food Wisdom** | **30 HOURS** |
| History - Introduction, Food consumed in different regions of India, Eating styles of India, Traditional equipment's used for cooking, changes in consumption of foods, Future of traditional foods, Advantages, types, health benefits of Indian food, Millets – Importance of millets in diet, millet as a medicine etc. | | |
| **Track 15** | **Creative Writing** | **30 HOURS** |
| This syllabus offers an introduction to the fundamentals of creative writing, beginning with techniques on how to read like a reader and understand literary aspects across different genres and forms. The course delves into various types of writing, including short stories, poetry, and blogs. In the Short Story Writing section, students will explore key elements of storytelling, learn effective writing techniques, and engage in practical exercises to craft their own stories. The Poetry Writing module includes reading and analyzing poems, discussing contemporary poets and their work, followed by generative exercises and review sessions for writing original poems. The Blog Writing segment introduces the concept of blogging, explores different types of blogs, and provides practical experience in writing and publishing blog posts. Throughout the course, students will enhance their creative expression through various writing practices and peer reviews. | | |
| **Track 16** | **Cinematography** | **30 HOURS** |
| A Basic Cinematography could focus on: Fundamental Concepts: Exposure, aperture, shutter speed, ISO, and their interplay. Composition: Rule of thirds, leading lines, depth of field, and framing techniques. Lighting: Three-point lighting, high-key and low-key lighting, and color temperature. Camera Movement: Panning, tilting, tracking, zooming, and their effects on storytelling. Lenses: Wide-angle, normal, and telephoto lenses, and their use in different situations. Basic Equipment: Understanding cameras, lenses, tripods, and other essential gear. By covering these essential elements, a basic cinematography can provide a solid foundation for beginners to grasp the core principles of filmmaking. | | |

| Track 17 | Podcasting | 30 HOURS |
|---|---|---|

Introduction to Podcasting: Overview of podcasting, types of podcasts, and the current landscape. Concept Development: Identifying your niche, target audience, and defining podcast goals. Equipment and Software Basics: Overview of microphones, recording software, and setting up a recording environment. Recording Techniques: Best practices for recording quality audio, including voice techniques and interview skills. Editing Basics: Introduction to editing software, cutting, splicing, and adding basic sound effects. Branding and Cover Art: Creating a strong podcast name, logo, and cover art that resonates with your audience. Hosting and Distribution: Choosing a hosting platform, understanding RSS feeds, and submitting to directories. Marketing and Promotion: Strategies for promoting your podcast through social media, SEO, and collaborations. Monetization Strategies: Exploring sponsor- ships, advertisements, and crowdfunding opportunities. Analytics and Growth: Understanding podcast analytics, audience engagement, and strategies for scaling your podcast.

| Track 18 | Public Speaking | 30 HOURS |
|---|---|---|

Introduction to Public Speaking: Understanding the fundamentals and importance of effective communication. Speech Structure: Crafting clear, compelling openings, bodies, and conclusions. Audience Analysis: Tailoring content and delivery to engage different audiences. Verbal and Nonverbal Communication: Mastering tone, pitch, gestures, and body language. Overcoming Speech Anxiety: Techniques for managing nervousness and building confidence. Persuasive Speaking: Strategies for convincing and influencing audiences. Impromptu Speaking: Developing skills for spontaneous speech delivery. Use of Visual Aids: Enhancing speeches with slides, props, and other media. Effective Storytelling: Using stories to connect with and captivate audiences. Final Speech Presentation: Delivering a polished speech with peer and instructor feedback.

| Track 19 | Regional Language Literature | 30 HOURS |
|---|---|---|

The syllabus offers a comprehensive exploration of Marathi literature, focusing on its history and various streams. It highlights prominent Marathi story writers and their distinctive features, providing insight into different storytelling styles and techniques. Students will learn about the essential elements of a story, including plot, characters, dialogue, and events, and develop skills in story reading, such as voice modulation, rhythm, and expression. The course covers techniques for effective story presentation on stage, emphasizing audience engagement. Additionally, it addresses the importance and methods of selecting stories on diverse topics. Students will also learn the basics of story writing, with opportunities to craft their own stories. The syllabus includes the reading and discussion of famous Marathi stories, culminating in a practical session where students present their storytelling, receive feedback, and gain guidance for improvement.

| Track 20 | Creative Graphics | 30 HOURS |
|---|---|---|

This syllabus provides a comprehensive introduction to graphic design, focusing on the concept of a ”creative” and its importance in the design process. It explores key aspects of creativity in graphic design, including various types of creatives and how to select the appropriate one based on the intended purpose. The course delves into different tools used in graphic design, with a special emphasis on CANVA as an effective design tool. Students will get familiar with the CANVA interface, learn to select appropriate design templates, and choose suitable elements for their projects. The syllabus also covers sourcing license-free and copyright-free images to enhance designs. The course culminates in creating effective creatives and building a portfolio of completed designs, equipping students with the skills and knowledge needed to succeed in graphic design.

| Track 21 | Indian Dietary Practices | 30 HOURS |
|---|---|---|

This syllabus explores the power and benefits of Indian traditional foods, focusing on their rich nutritional value and significant health advantages. It delves into the world of Indian superfoods, with a particular emphasis on millet, highlighting its role and importance in maintaining a balanced diet. The course offers an in-depth examination of the diverse foods consumed across different regions of India, taking into account various dietary restrictions, cultural influences, and the role these factors play in shaping regional food choices. Additionally, it emphasizes the importance of understanding and appreciating the vast regional diversity in Indian cuisine, and how these traditional diets contribute to overall health and well-being. Through this course, students will gain a comprehensive understanding of the significance of traditional Indian foods and how they can be integrated into modern dietary practices for enhanced health benefits.

**NOTE :** More tracks can be added as per demand of the students and feasibility.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY (IT) | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Indian Knowledge Systems: Vedic Mathematics |
| | COURSE CODE | 2308181 |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 25 | NIL | 50 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2308181.CEO.1: To facilitate the students with the concepts of Indian traditional knowledge
2308181.CEO.2: To make them understand the Importance of roots of knowledge system.
2308181.CEO.3: To encourage students to think creatively and critically about mathematical concepts
2308181.CEO.4: To bring forward the extraordinary work done by Indian Mathematicians in the fields such as Astronomy, Astrology, Geometry, Algebra, and Arithmetic etc.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308181.CO.1: Explain the historicity and broad classification of Indian knowledge System [L2].
2308181.CO.2: Demonstrate key Vedic Mathematics principles by understanding foundational concepts and providing clear insights into the underlying principles and relationships [L2].
2308181.CO.3: Apply Vedic mathematics methods to solve a variety of mathematical problems, showcasing proficiency in applying these techniques to diverse scenarios [L3].
2308181.CO.4: Analyze and evaluate the efficiency and suitability of different Vedic mathematics approaches in solving specific types of problems demonstrated through a detailed project or case study presentation [L3].

**COURSE ABSTRACT:**

Course outlines the importance of Indian Knowledge System and its contributions to diverse fields.This course will help learners to know and understand their own systems and traditions which are imperative for any real development and progress. Because of this course learners will think independently and originally with Indian frameworks and models for solving the problems of present day. Vedic Mathematics will not have direct application in Computer Engineering as a specialized field, however it offers benefits and insights that are relevant in certain context. It will be used in logic development, Problem Solving, data analysis and designing of algorithms. Recognizing methodologies to simplify calculation is one of the skill in Vedic Mathematics. This skill can be valuable in dealing with complex real life applications.Deeper concepts helpful in Programming context, problem solving skills can be considered as outcomes of Vedic Mathematics in Computer Engineering discipline.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Indian Knowledge System – An Introduction** | **04 HOURS** |

**Applications/Case Study:** Connections between different fields of study and an affection for traditional knowledge

**Contents:** Introduction and need of IKS; historic importance of IKS; Why do we need IKS; Organization of IKS; Historicity of IKS; Some salient aspects of IKS

**Further Readings/Self Study:** Linkage of Mathematics and IKS

| | | |
|---|---|---|
| **UNIT 2** | **Introduction to Indian Mathematics** | **02 HOURS** |

**Applications/Case Study:** Mathematical Innovations in $17^{th}$ and $18^{th}$ Century

**Contents:** Introduction to Indian Mathematics; Unique aspects of Indian Mathematics; Indian Mathematicians and their Contributions

**Further Readings/Self Study:** Impact of Mathematical Innovations on society

| | | |
|---|---|---|
| **UNIT 3** | **Deep Insights in to Indian Mathematics** | **12 HOURS** |

**Applications/Case Study:** Basic Sutras and subsutras in Vedic Mathematics

**Contents:** Arithmetic; Algebra; Geometry; Trigonometry; Binary mathematics and combinational problems in Chandaḥ Śāstra; Magic squares in India

**Further Readings/Self Study:** application of Chandaḥ Śāstra in designing of algorithms

| | | |
|---|---|---|
| **UNIT 4** | **Astronomy** | **04 HOURS** |

**Applications/Case Study:** Linear measures of celestial coordinate system.

**Contents:** Unique Aspects of Indian Astronomy, Historical Development, The Celestial Coordinate System, Elements of the Indian Calendar.

**Further Readings/Self Study:** Positional Astronomy.

| ACTIVITY(a) | Activity Based on IKS (25 Marks) | 01 HOUR |
|---|---|---|
| Activity based on the IKS will assess student's knowledge and comprehension of the course content. The purpose of the activity is to evaluate the participants' understanding and knowledge of IKS. | | |
| **ACTIVITY(b)** | **Field Visit and Report Writing (25 Marks)** | **08 HOURS** |

Students are required to conduct a field visit to the local places mentioned below.Upon completion of the field visit, students must write a report on the visit, its analysis,and submit the detail report for assessment

**Field Visit Guideline :**

**Archaeological Sites:** Visit archaeological sites like ancient temples and caves (Karla, Bhaja Bedse Caves, old temples) Vedic mathematics emphasizes geometric principles and formulas. These principles may have been applied in the design and construction of ancient temples and caves. These architecture often involves intricate geometric patterns and proportions, which could have been influenced by Vedic mathematical concepts.

**Museums:** Explore museums that exhibit ancient artifacts, tools, and techniques. (Raja Dinkar Kelkar Museum, Mahatma Phule Museum, Deccan College Museum, Darshan Museum) Observe any mathematical symbols, notations, or representations found in ancient artifacts. These can provide clues about how mathematical concepts were recorded and communicated in ancient times.

**Historical Monuments:** Visit historical sites featuring iconic artifacts. (Aga Khan Palace, Shaniwar Wada, Sinhgad Fort) Recognize the interdisciplinary nature of Vedic mathematics by understanding its connections to architecture, astronomy, and religious practices. Explore how mathematics played a role in these diverse fields. Appreciate the importance of preserving and conserving archaeological sites that offer insights into Vedic mathematics and ancient knowledge systems.

**Educational Institutions:** Visit universities or research institutes with metallurgy depart- ments. These institutions often have laboratories and facilities that demonstrate cutting-edge research in Mathematics e.g. Savitribai Phule Pune University, Indian Institute of Science Education and Research (IISER), College Technological University, Pune (COEP) Recognize how the mathematical achieve- ments of ancient India, including Vedic mathematics, continue to inspire modern mathematicians and educators.

| ACTIVITY(c) | Multimodal Activities (25 Marks) | 04 HOURS |
|---|---|---|

Students are required to perform any one activity as assessment and submit: The activity evaluates students understanding and application of Vedic Mathematics principles. It includes a range of mathematical problems and calculations based on Vedic techniques. Assessment criteria may encompass accuracy, speed, and proficiency in employing Vedic Math methods to problems.

**Poster Presentation:** Students are required to create a visually appealing and informative poster that summarizes a specific topic or concept related to the course. The poster should effectively convey key points, including information, visuals. Assessment criteria may include content clarity, visual design, organization, and the ability to articulate ideas during the presentation.

**Video Documentary:** Students are tasked with producing a short video documentary that explores a particular aspect of the course. This assessment component encourages students to research, script, film, and edit a video that presents their chosen topic in a compelling and informative manner. Evaluation criteria may include content accuracy, storytelling, production quality, and overall impact.

**Model Making:** In this task, students are asked to create a physical model or representation of a concept or object relevant to the course. The model should demonstrate a deep understanding of the subject matter and may include annotations or explanations to clarify its significance. Assess- ment criteria could include accuracy, creativity, craftsmanship, and the ability to explain the model's relevance.

**Product Making:** This component challenges students to design and produce a practical product or prototype related to the course content. Students design and craft practical products or prototypes inspired by Indian Knowledge System principles. This hands-on activity fosters creativity and practical application of IKS Students may need to consider materials, functionality, and how their product addresses a real-world problem or application. Evaluation might focus

## TEXT BOOKS


1. Mahadevan B., Pavana N., Bhat Vinayak R.,(2022). *Introduction to Indian Knowledge System: Concepts and Applications*. 1st Edition, PHI Learning. ISBN 978-9391818203.

2. Patil Chaitanya A.,(2018). *Learn Vedic Speed Mathematics Systematically and Step by Step*. 1st Edition, Chaitanya A. Patil Publication. ISBN 9789353008406.


## REFERENCE BOOKS


1. Bose, D. M. Sen, S.N. Subbarayappa,B. V. (2010). A Concise History of Science in India. 2nd Edition, Universities Press Publisher, Hyderabad. ISBN 9788173716195.
2. Boyer Carl B., (2011). A History of Mathematics. 3rd Edition. Wiley Publication. ISBN 9780470630563

3. Cooke Roger L. (2011). The History of Mathematics: A Brief Course. 2ND Edition. Wiley Publication. ISBN 9781118030240

**E-RESOURCES**

1. *https : //www.youtube.com/playlist?list = PLrpY UF 9DFV UNOwBtrT 5QfnJKk3pqCL7i*

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Statistics and Integral Calculus |
| | COURSE CODE | 2301103T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2301103T.CEO.1: To extend the basic concepts of integration for evaluation of complex integration problems.
2301103T.CEO.2: To categorize and use equation of curves to trace the given curve.
2301103T.CEO.3: To demonstrate an understanding towards evaluating multiple integrals.
2301103T.CEO.4: To relate and examine the applications of multiple integrals.
2301103T.CEO.5: To study different statistical methods for solving problems.
2301103T.CEO.6: To analyse different probability distribution functions.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301103T.CO.1: Evaluate complex integrals [L3].
2301103T.CO.2: Sketch curves by analysing the given equation of curves [L3].
2301103T.CO.3: Evaluate the multiple integrals [L3].
2301103T.CO.4: Apply the knowledge of multiple integrals to solve engineering problems [L3].
2301103T.CO.5: Assess statistical problems [L4].
2301103T.CO.6: Solve the probability distribution problems [L3].

## COURSE ABSTRACT

This course includes some of the main ideas on integral calculus, a wide domain of mathematics that has many applications relevant to the future engineer. Also included different methods of computing integrals and applications of multiple integrals as area, volume, centre of gravity and moment of iner- tia using different types of examples.Main objective of this course is to identify different methods to evaluate integrals, to demonstrate an understanding towards evaluating multiple integrals, to relate and examine the applications of multiple integrals, to analyze different probability distribution functions, to study different statistical methods for solving problems.It explains the concepts of probability theory and statistics which are needed for handling various real- world problems.As a part of the studies we emphasize more on real life applications of the topics and based on that different activities are also conducting in timely manner. By doing this we inculcate the curiosity of the students towards research.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Integral Calculus** | **08 HOURS** |
| **Contents:** Reduction formulae, Gamma function, Beta function, Differentiation under integral sign.<br>**Self Study:** DUIS rule 2 | | |
| **UNIT 2** | **Curve Tracing and Rectification** | **07 HOURS** |
| **Applications/Case Study:** Rose Curves<br>**Contents:** Tracing of Curves: Cartesian curves, Parametric curves, Polar curves. Rectification: Rec- tification of Cartesian, Parametric and Polar curves .<br>**Self Study:** Parametric Curves . | | |
| **UNIT 3** | **Multiple Integrals** | **07 HOURS** |
| **Contents:** Double integration, Evaluation of Double integration, Change of order of Integration, Integration by transforming Cartesian to polar coordinate systems, Triple Integration, Integration by transforming to spherical and cylindrical polar coordinates.<br>**Self Study:** Coordinate system. | | |
| **UNIT 4** | **Applications of Multiple Integrals** | **07 HOURS** |
| **Contents:** Applications of multiple integrals to find Area, Volume, Centre of Gravity, and<br>**Self Study:** Moment of Inertia. | | |
| **UNIT 5** | **Statistics** | **08 HOURS** |
| **Applications/Case Study:** Corona Graph.<br>**Contents:** Measures of central tendency, standard deviation, coefficient of variation, moments, skew- ness and kurtosis, correlation(Karl Pearson's coefficient of correlation) and regression .<br>**Self Study:** Measures of Central Tendency,Standard Deviation,Coefficient of Variation | | |
| **UNIT 6** | **Probability** | **08 HOURS** |
| **Contents:** Probability, probability density function, probability distribution: Binomial, Poisson, Nor- mal.<br>**Self Study:** Bayes' Theorem. | | |

## TEXT BOOKS


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.


## REFERENCE BOOKS


1. Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379-8858). Addison-Wesley.
2. Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.
3. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.
4. Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.
5. O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.
6. Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.
7. Montgomery, D. C., & Runger, G. C. (2010). Applied statistics and probability for engineers. John wiley & sons.
8. Johnson, R. A., Miller, I., & Freund, J. E. (2000). Probability and statistics for engineers (Vol. 2000, p. 642p). London: Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Statistics and Integral Calculus Tutorial |
| | COURSE CODE | 2301103U |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 1 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2301103U.CEO.1: To extend the basic concepts of integration for evaluation of complex integration problems.
2301103U.CEO.2: To categorize and use equation of curves to trace the given curve.
2301103U.CEO.3: To demonstrate an understanding towards evaluating multiple integrals.
2301103U.CEO.4: To relate and examine the applications of multiple integrals.
2301103U.CEO.5: To study different statistical methods for solving problems.
2301103U.CEO.6: To analyse different probability distribution functions.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301103U.CO.1: Evaluate complex integrals [L3].
2301103U.CO.2: Sketch curves by analysing the given equation of curves [L3].
2301103U.CO.3: Evaluate the multiple integrals [L3].
2301103U.CO.4: Apply the knowledge of multiple integrals to solve engineering problems [L3].
2301103U.CO.5: Assess statistical problems [L4].
2301103U.CO.6: Solve the probability distribution problems [L3].

## COURSE ABSTRACT

This course includes some of the main ideas on integral calculus, a wide domain of mathematics that has many applications relevant to the future engineer. Also included different methods of computing integrals and applications of multiple integrals as area, volume, centre of gravity and moment of iner- tia using different types of examples.Main objective of this course is to identify different methods to evaluate integrals, to demonstrate an understanding towards evaluating multiple integrals, to relate and examine the applications of multiple integrals, to analyze different probability distribution functions, to study different statistical methods for solving problems.It explains the concepts of probability theory and statistics which are needed for handling various real- world problems.As a part of the studies we emphasize more on real life applications of the topics and based on that different activities are also conducting in timely manner. By doing this we inculcate the curiosity of the students towards research.

| **TUTORIALS** | | |
|---|---|---|
| **TUTORIAL NO.01** | **Integral Calculus** | **01 HOUR** |
| Reduction formulae, Gamma function. | | |
| **TUTORIAL NO.02** | **Integral Calculus** | **01 HOUR** |
| Beta function, DUIS Rule1 & 2. | | |
| **TUTORIAL NO.03** | **Curve Tracing** | **01 HOUR** |
| Tracing of Cartesian, Polar and Parametric curves. | | |
| **TUTORIAL NO.04** | **Rectification** | **01 HOUR** |
| Rectification of Cartesian, Polar and Parametric curves. | | |
| **TUTORIAL NO.05** | **Double Integration** | **01 HOUR** |
| Double Integration, Evaluation of Double Integration, Change the order of integration, Integration by transforming Cartesian to Polar Coordinate system. | | |
| **TUTORIAL NO.06** | **Triple Integration** | **01 HOUR** |
| Triple integration, Integration by transforming to spherical and cylindrical polar coordinates. Appli- cation Of multiple integrals: To find Area, Volume. | | |
| **TUTORIAL NO.07** | **Applications of Multiple Integrals** | **01 HOUR** |
| Applications of multiple integrals: To find Centre of Gravity of an arc, plane lamina and a solid. | | |
| **TUTORIAL NO.08** | **Applications of Multiple Integrals** | **01 HOUR** |
| Applications of multiple integrals: To find Moment of Inertia about an arc, plane and solid. | | |
| **TUTORIAL NO.09** | **Statistics** | **01 HOUR** |
| Measures of central tendency, standard deviation, coefficient of variation. | | |
| **TUTORIAL NO.10** | **Statistics** | **01 HOUR** |
| Moments, skewness and kurtosis, Correlation and regression. | | |

| | | |
|---|---|---|
| **TUTORIAL NO.11** | **Probability** | **01 HOUR** |
| Probability, probability density function. | | |
| **TUTORIAL NO.12** | **Probability** | **01 HOUR** |
| , Probability distribution: Binomial, Poisson, Normal. | | |
| **TUTORIAL NO.13** | **Guest Lecture** | **02 HOUR** |
| Applications of statistics in real life. | | |
| **TUTORIAL NO.14** | **Doubt Clearing Session** | **01 HOUR** |
| Unit 1 - Unit 6. | | |

## TEXT BOOKS


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.


## REFERENCE BOOKS


1. Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379-8858). Addison-Wesley.
2. Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.
3. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.
4. Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.
5. O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.
6. Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.
7. Montgomery, D. C., & Runger, G. C. (2010). Applied statistics and probability for engineers. John wiley & sons.
8. Johnson, R. A., Miller, I., & Freund, J. E. (2000). Probability and statistics for engineers (Vol. 2000, p. 642p). London: Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Engineering Physics |
| | COURSE CODE | 2301102T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

## COURSE OBJECTIVES :

2301102T.CEO.1: Make students identify the basic concept of measurements and to formulate problems in physical and mathematical terms.

2301102T.CEO.2: Analyze the behavior of light as a wave and get acquaint with different applications in Physics.

2301102T.CEO.3: Classify and understand the difference of classical mechanics and quantum mechanics.

2301102T.CEO.4: Derive the basic laws governing the motion of quantum particles.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301102T.CO.1: Make use of the basics of measurement aspects to obtain acceptable solutions under given conditions [L3].

2301102T.CO.2: Infer theoretical principles of optical phenomenon observed in daily life experience [L4].

2301102T.CO.3: Apply the knowledge of quantum mechanics to study the behavior of quantum particles [L3].

2301102T.CO.4: Analyze the necessity of quantum mechanics in context of failure of classical mechanics [L4].

## COURSE ABSTRACT

Since 'technology' has been generally understood as the application of 'science' to find answers to questions confronting us in a wide spectrum of inquiry, so a profound understanding of science is necessary to facilitate building sound intellectual capacity in the area of technology. Various areas of engineering studies are found to be applying concepts discussed in Physics as for instance measurement, optics, quantum-mechanics to name a few which have been instrumental/ pivotal in the development of Engineering branches like Robotics, Mechanical Engineering, Computer Science, Chemical Engineering, Civil Engineering and Electronics and Telecommunications; besides other specific allied areas as Ar- tificial Intelligence, Big-Data Analysis and Quantum Computing. The course of Engineering Physics discusses the basics and analyses the understanding of topics like measurement of physical variables, wave-phenomenon, basics of Quantum Mechanics and its applications thereof. Most of the contents of this course act as a mandatory in terms of extrapolating its further extension to address the basics of Quantum Computing and other such emerging technologies.

## THEORY COURSE CONTENTS

| UNIT 1 | Measurement of Physical Quantities | 6 HOURS |
|---|---|---|

**Applications/Case Study:** Measuring methods in classical mechanics, measuring methods in quantum mechanics.

**Contents:** Concept of (i)significant numbers, (ii) accuracy versus precision (iii)error versus uncertainty (iv)systematic error versus random error (v) quantifying the uncertainty. Least-count of an apparatus, Methods to measure least-count with specific examples of travelling microscope and spectrometer. importance of estimation and guesstimation in measurement.

**Self Study:** Span (orders of magnitude) of prominent physical parameters. Length-scale and time-scale of specific physical phenomenon, classical-mechanical-measurement versus quantum-mechanical-measurement.

| UNIT 2 | Wave Properties of Light | 8 HOURS |
|---|---|---|

**Applications/Case Study:**Coating of lenses as an application of thin film interference.

**Contents:** Particle nature and wave-nature with examples of wave and particle behavior of light, Introduction to wave nature, Concept of thin film, Stokes law of phase-change on reflection from a thin film, Thin film interference, Interference in films of uniform and non-uniform thickness (with derivation), Newton Ring Experiment, basics of polarization of electromagnetic wave.

**Self Study:** Superposition Principle, Applications of thin-film interference, Diffraction as a particular case of interference, Application of polarized light.

| UNIT 3 | Quantum Mechanics-I | 8 HOURS |
|---|---|---|

**Applications/Case Study:** Plank's quantum law of blackbody radiation

**Contents:** Shortcomings or failure of Classical Mechanics (with specific example of blackbody radiation), Matter-waves, De-Broglie's concept of matter waves, Heisenberg's Uncertainty Principle.

**Self Study:** Blackbody radiation.

| UNIT 4 | Quantum Mechanics-II | 8 HOURS |
|---|---|---|

**Applications/Case Study:** Application of electron in a potential well in case of Bohr's atomic model.
**Contents:** Wave-function, Physical significance of wave function, Schrodinger's equations, Time Dependent and Time Independent forms of Schrodinger Equations, Applications of Schrodinger Equation, Electron in an infinite potential well (rigid box).
**Self Study:** Electron in a finite deep potential well (non-rigid box).
**Further Study:** Concept of quantum mechanical tunneling

## TEXT BOOKS


1. Feynman R.P., Leighton R.B., Sands M. (2013). The Feynman Lectures on Physics: (Vols.1-3) Narosa Publishing House.
2. Ghatak A. (2016). Optics (6th edition). TMH.


## REFERENCE BOOKS


1. Morris A.S. (2001). Measurement and Instrumentation Principles (3rd edition). Butterworth Heinemann.
2. Jenkins & White (2016). Fundamentals of Optics (4th edition). Mc Graw Hill Science.
3. Beiser A., Mahajan S., Choudhary S.R. (2009) Concepts of Modern Physics (6th edition). Mc Graw Hill Education (India) Pvt. Ltd.
4. Schiff L.I., Bandhyopadhyay J. (2017) Quantum Mechanics (4th edition). MH Education (India) Pvt. Ltd.
5. Dirac P.A.M. (2004) Principles of Quantum Mechanics (4th edition). CBS publishers and Distributors 2004.
6. Griffiths D.J. (2016) Introduction to Quantum Mechanics (2nd edition). Cambridge India.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Engineering Physics Lab |
| | COURSE CODE | 2301102L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

## COURSE OBJECTIVES :

2301102L.CEO.1: To acquire hands-on experience in setting up and using fundamental physics apparatus.

2301102L.CEO.2: To cultivate students' ability to conduct experiments, analyze data, and draw meaningful conclusions.

2301102L.CEO.3: Encourage students to identify sources of experimental error, and propose improvements.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301102L.CO.1: Demonstrate proficiency in using basic laboratory equipment relevant to physics experiments [L2].

2301102L.CO.2: Develop analytical skills to analyze the experimental data obtained from measurement of physical variables [L3].

2301102L.CO.3: Develop improved experimental-skills evidenced by their ability to identify sources of errors and propose appropriate precautions [L3].

## COURSE ABSTRACT

Since 'technology' has been generally understood as the application of 'science' to find answers to questions confronting us in a wide spectrum of inquiry, so a profound understanding of science is necessary to facilitate building sound intellectual capacity in the area of technology. Various areas of engineering studies are found to be applying concepts discussed in Physics as for instance measurement, optics, quantum-mechanics to name a few which have been instrumental/ pivotal in the development of Engineering branches like Robotics, Mechanical Engineering, Computer Science, Chemical Engineering, Civil Engineering and Electronics and Telecommunications; besides other specific allied areas as Ar- tificial Intelligence, Big-Data Analysis and Quantum Computing. The course of Engineering Physics discusses the basics and analyses the understanding of topics like measurement of physical variables, wave-phenomenon, basics of Quantum Mechanics and its applications thereof. Most of the contents of this course act as a mandatory in terms of extrapolating its further extension to address the basics of Quantum Computing and other such emerging technologies.

**PRACTICALS**: Seven (7) number of experiments among those listed below to be conducted. Maximum two experiments may be substituted (by faculty in consultation with students) with Experimental hands-on activity/ies among those listed below.

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Interpretation of given data** | **2 HOURS** |
| Analysis of a given data set in terms of implied uncertainties and tolerance to evaluate validity of a result. (Note: The given data may be in terms of graph as well). | | |
| **PRACTICAL NO.02** | **Estimation and guesstimation** | **2 HOURS** |
| To predict the expected outcome of a given experimental problem under scientific reasoning justifying the experimental conditions. | | |
| **PRACTICAL NO.03** | **Significant Figures** | **2 HOURS** |
| Determination of the mass of electron (me) upto specified significant numbers. | | |
| **PRACTICAL NO.04** | **Interference of Light Waves** | **2 HOURS** |
| Calculate the refractive index of a given liquid using Newton Rings' Experiment. | | |
| **PRACTICAL NO.05** | **Diffraction of Light Waves** | **2 HOURS** |
| Determination of the line density of a diffraction grating using Laser. | | |
| **PRACTICAL NO.06** | **Interference of Light Waves** | **2 HOURS** |
| Calculate the wavelength of Sodium light source using Michelson Interferometer. | | |
| **PRACTICAL NO.07** | **Phase and Phase-Difference** | **2 HOURS** |
| Determination of the phase-difference between two given positions on the path of simple pendulum in periodic motion. | | |
| **PRACTICAL NO.08** | **Polarization** | **2 HOURS** |
| Determination of the specific rotation of a sugar solution of a given concentration. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.9** | **Division of Amplitude of Light Waves** | **2 HOURS** |
| Determination of Radius of Curvature of a given planoconvex lens using Newton's Rings apparatus. | | |
| **PRACTICAL NO.10** | **Diffraction as a Particular Case of Interference** | **2 HOURS** |
| Calculation of wavelength of different colors using a white light. | | |
| **PRACTICAL NO.11** | **Malus' Law** | **2 HOURS** |
| Verification of Malus' law under experimental conditions. | | |
| **PRACTICAL NO.12** | **Brewster's Law** | **2 HOURS** |
| Determination of refractive index of given unknown material. | | |
| **Hands-on Activity No.1** | **Wave/ Quantum mechanics: Effect of measurement on the state of an observable** | **4 HOURS** |
| Measuring the change in state of an observable using Malus' law under experimental conditions. | | |
| **Hands-on Activity No.2** | **Significant digits in experimental result** | **2 HOURS** |
| Number of significant digits in the obtained result as a function of different methods used to determine a physical variable/ observable. | | |

## TEXT BOOKS


1. Worsnop B.L., Flint H.T. (2002). Advanced practical Physics for students. Methuen & Co. Ltd. https://archive.org/details/in.ernet.dli.2015.86393/page/n7/mode/2up.
2. Ghatak A. (2021). The ten most beautiful experiments in science. (1st edition). Viva Books.


## REFERENCE BOOKS


1. Worsnop B.L., Flint H.T. (2002). Advanced practical Physics for students. Methuen & Co. Ltd. https://archive.org/details/in.ernet.dli.2015.86393/page/n7/mode/2up.
2. Ghatak A. (2021). The ten most beautiful experiments in science. (1st edition). Viva Books.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Electrical & Electronics Engineering |
| | COURSE CODE | 2307101T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307101T.CEO.1: To impart knowledge of single-phase and three-phase AC circuits.
2307101T.CEO.2: To get acquainted with different electrical machines.
2307101T.CEO.3: To familiarize with blocks of DC power supply and BJT operation.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2307101T.CO.1: Illustrate Single Phase and three phase Systems [L2].
2307101T.CO.2: Identify electrical machines used in typical domestic and industrial Application [L3].
2307101T.CO.3: Construct analog circuits using suitable components [L3].

## COURSE ABSTRACT:

This course focuses on developing important technical concepts in a comprehensible, coherent and rigorous way. This comprehensive course provides students with a solid foundation in the principles, theories and practical applications of Electrical and Electronics Engineering. Students will delve into the fundamental concepts of electrical circuits, power analysis, semiconductor devices and digital electronics. Students will also explore the intricate world of semiconductor devices including diodes, transistors, power supply design and uncover their applications in electronic circuits.

## THEORY COURSE CONTENT

| | | |
|---|---|---|
| **UNIT 1** | **Single Phase Electrical Systems** | **6 HOURS** |

**Contents:** Introduction to basic Electrical elements, AC fundamentals, Series and Parallel AC circuits, Power ratings of home appliances (fan, tube light, mixer etc), Study of Electrical connection of house, Fuse, MCBs and grounding for safety at home.

**Activity:** Energy Consumption calculation for your Home

**Self Study:** 1.To study Ohms Law, KCL-KVL 2.Use of Basic Electrical Elements in house

| | | |
|---|---|---|
| **UNIT 2** | **Three Phase Electrical Systems** | **5 HOURS** |

**Contents:** Introduction to Three Phase systems, Delta and Star connections, Relation between line and phase quantities (with Phasor Diagrams), Power in three phase circuits for Star and Delta connections, Introduction to Indian Power system

**Activity:** Overview of Indian Power Scenario- Flipped Classroom

**Self Study:** Selections of Star and Delta Connections as per load requirements

| | | |
|---|---|---|
| **UNIT 3** | **Electrical Machines** | **06 HOURS** |

**Contents:** Single Phase Transformers: Construction, Types, Working Principle, EMF equation, Efficiency

DC Motor: Construction, Working principle, Types of DC Motors, Torque-speed characteristics

**Activity:** Study of Motors used in Various applications-Mind map

**Self Study:** Basics of PMDC, BLDC, Stepper motor, Single Phase AC Motors

| | | |
|---|---|---|
| **UNIT 4** | **Analog Electronics and Power Supply Design** | **06 HOURS** |

**Contents:** Diode, Clipper circuits, Rectifier circuits, DC Regulated power supply, BJT: Construction, Configurations, DC Load Line, Q-point, Switch and Amplifier

**Activity:** Build and Simulate standard circuit using any Mobile application

**Self Study:** Study of Clamper Circuit

| UNIT 5 | Digital Systems | 7 HOURS |
|---|---|---|

**Contents:** Number systems, Logic gates, SOP, K-Map, Combinational circuits: Adder, Subtractor, Mux, Code converter, Sequential circuit: Flip-Flops, Register

**Activity:** K-Map Puzzle

**Self Study:**

1- Programmable Logic Devices (PLDs)

2- Digital Circuit Simulators

## TEXT BOOKS


1. Edward Hughes (2011) *"Electrical and Electronic Technology"* , 10th edition, Pearson India, ISBN-13: 978-8131733660
2. Thomas L. Floyd (2018) *"Electronics Devices"*, 10th edition, Pearson Education India, ISBN-13: 978-1292222998
3. A. Anand Kumar (2016) *"Fundamentals of Digital Circuits"*, 4th edition, Prentice Hall of India, ISBN-13: 978-8120352681


## REFERENCE BOOKS


1. V. N. Mittle and Arvind Mittal (2005). *"Basic Electrical Engineering"*, 2nd edition, McGraw Hill Education, ISBN-13: 978-0070593572
2. D. P. Kothari,I.J.Nagrath (2010). *"Electric Machines"*, 4th edition, McGraw Hill. ISBN: 978-0070699670.
3. Paul Horowitz, Winfield Hill *"The Art of Electronics"*, 3rd edition,Cambridge University press, ISBN: 978-0521809269


## E-RESOURCES

1. *"https : //www.google.com/url?q = https : //onlinecourses.nptel.ac.in/noc25ee04/preview&sa = D&source = editors&ust = 1734508653203993&usg = AOvVaw3ChhKg2vV4RC2sK – sKhDWM"*

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Electrical & Electronics Engineering Lab |
| | COURSE CODE | 2307101L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307101T.CEO.1: To relate truth tables and logic expressions for various digital application.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2307101T.CO.1: Make use of OC and SC Test on Transformer to predict its efficiency at various Loading conditions [L3].

2307101T.CO.2: Illustrate applications of BJT in terms of Switch and Amplifier [L2].

2307101T.CO.3: Develop adder circuits using suitable ICs [L3].

**COURSE ABSTRACT:**

The course Electrical and Electronics Engineering combines theory with hands on laboratory experi- ments where students will have the opportunity to construct and test electronics circuits and work with real world electrical devices.

| **PRACTICALS** | | |
|---|---|---|
| **SESSION NO.1** | **Overview in First Session** | **2 HOURS** |
| a. Three phase voltage generation and its waveform<br>b. General structure of Electrical Power System, three phase 4-wire system (introductory approach)<br>c. Safety measures in electrical system, benefits of energy conservation<br>d. Introduction to DMM, Dimmer stat / Variac, CRO/DSO, Function generator<br>e. Introduction to breadboard and its working | | |
| **PRACTICAL NO.1** | **R-L-C series A.C. Circuit** | **2 HOURS** |
| a. To calculate exact values of R, L and C for variations in XL and XC (2 cases)<br>b. To justify the lagging and Leading nature for any two cases | | |
| **PRACTICAL NO.2** | **Verification of relation between Line and Phase quantities in Star and Delta circuits** | **4 HOURS** |
| a. To understand Line, Phase quantities and types of connections in Three phase supply<br>b. To connect Bulb load in Star and Delta connection to verify the relation between Line and Phase Quantities<br>**Activity 01: A.C. Circuit Analysis:** To demonstrate concepts like phase, frequency and peak-to-peak voltage on CRO/DSO | | |
| **PRACTICAL NO.3** | **Open circuit and Short circuit test on a Single-Phase transformer** | **2 HOURS** |
| a. To find iron losses and no-load circuit parameters<br>b. To find full load copper losses and Equivalent circuit parameters<br>c. To determine efficiency and regulation of transformers at various different loading conditions<br>**Activity 02: Simple DC Motor Model:**<br>a. Build a basic model of DC Motor using coil of wire, a magnet and a battery<br>b. Make the coil to rotate (Apply concept of Magnetic field and current) | | |

| PRACTICAL NO.4 | DC Regulated Power Supply | 4 HOURS |
|---|---|---|
| a. To design Half and Full Wave Rectifier Circuits by using breadboard<br>b. To understand 12V/ 9V/ 5V IC based DC regulated power supply (Theoretically) with Datasheets<br>c. To test and observe waveforms at various stages on CRO and measure the voltage using DMM | | |
| **PRACTICAL NO.5** | **BJT as a switch and Amplifier** | **4 HOURS** |
| a. BJT as a switch – On/Off the LED at the output by switching BJT<br>b. BJT as an Amplifier – Measure voltages and observe waveforms at input and output of the single stage CE amplifier<br>**Activity 03: Diode Application:** Design Rectifier Circuits (HWR/FWR) on breadboard | | |
| **PRACTICAL NO.6** | **Logic Gates** | **4 HOURS** |
| To study and verify truth tables of Logic Gates (AND/OR/NAND/NOR) | | |
| **PRACTICAL NO.7** | **Combinational Circuits** | **4 HOURS** |
| a. To design and implement half adder and Full adder<br>b. To design and implement Full Adder by dual 4:1 MUX (IC-74LS153) and verify truth table | | |
| **PRACTICAL NO.8** | **Sequential Circuits (Flip Flops)** | **4 HOURS** |
| To verify Truth table of flip-flops practically using ICs<br>**Activity 04: Boolean Expressions:** Implementation and verification of Boolean Expression on breadboard | | |

## TEXT BOOKS


1. Edward Hughes (2011) *"Electrical and Electronic Technology"* , 10th edition, Pearson India, ISBN-13: 978-8131733660
2. Thomas L. Floyd (2018) *"Electronics Devices"*, 10th edition, Pearson Education India, ISBN-13: 978-1292222998
3. A. Anand Kumar (2016) *"Fundamentals of Digital Circuits"*, 4th edition, Prentice Hall of India, ISBN-13: 978-8120352681


## REFERENCE BOOKS


1. M. Morris Mano, Michael D. Ciletti *"Digital design"*, 4th edition,Pearson, ISBN: 978-0131989245


## E-RESOURCES

1. https://asnm-iitkgp.vlabs.ac.in/exp/rlc-circuit-analysis/simulation.html
2. https://de-iitr.vlabs.ac.in/List
3. https://www.falstad.com/circuit/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Essentials of Data Science |
| | COURSE CODE | 2304102T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PRE-REQUISITE :**

**COURSE OBJECTIVES :**

2304102T.CEO.1: To get familiar with the basics of Python programming.
2304102T.CEO.2: To learn different data structures in Data Science.
2304102T.CEO.3: To use data computation methods in Data Science.
2304102T.CEO.4: To introduce data manipulation methods in Data Science.
2304102T.CEO.5: To use data visualization methods in Data Science.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304102T.CO.1: Build a python program for handling syntax and semantics for any given problem[L3].
2304102T.CO.2: Demonstrate proficiency in handling data structures useful in Data Science[L3].
2304102T.CO.3: Apply the suitable methods of data computations on real time data[L3].
2304102T.CO.4: Interpret the different methods of data manipulation on real time data[L3].
2304102T.CO.5: Apply data visualization for real time data to get better insights[L3].

## COURSE ABSTRACT

Essentials of Data Science (EDS) is the First Year Semester-II course. This course aims at equipping learners to be able to provide the essence of Data Science by using python programming. In this course, firstly, the learners will learn python fundamentals required for Data Science. The learners are able to use different data organizational structures to store the real time data. Data computations are required to maintain the quality of data. EDS helps to learn different data computations. Data manipulations help in handling missing and noisy values in Data Processing. The learner will learn data storing, loading, cleaning, preparation, wrangling, transformation etc. Data visualization is the practice of translating information into a visual context, such as a map or graph which tends to identify the patterns, trends from the data. This course will increase the learner's interest in Data Science. The activity based learning is adapted to learn this course.

## THEORY COURSE CONTENT

| UNIT 1 | Python Fundamentals for Data Science | 6 HOURS |
|---|---|---|

**App/System/Case study:**Weather Analysis

**Contents:**Introduction, Data Types- Mutable and immutable types, Data Conditioning using Decision Statements and Iterative Statements.

Functions: Basics of functions, variable scope and lifetime, Lambda or anonymous function.

Modules: Introduction to modules, packages and standard library modules.

Data Handling using Files.

**Self Study:**CSV Reader and Writer

**Further Reading:**Excel Reader and Writer

| UNIT 2 | Data Organizational Structures | 6 HOURS |
|---|---|---|

**App/System/Case study:**Retail-Industry/Twitter Reviews

**Contents:**Categories of Data- Unstructured, Structured, Categorical and Time Series

List- Creating List, List operations

Tuple- List of Tuples, Immutability,

Dictionaries- Creating Dictionary, Adding to Dictionary with SetDefault, Loading JSON to Dictionary

Set- Removing Data from Sequences, Performing common data set operation

**Self Study:**JSON File Handling

**Further Reading:**XML File Handling

| UNIT 3 | Data Computation | 6 HOURS |
|---|---|---|

**App/System/Case study:**Stock Market

**Contents:**Data Operations- Arithmetic and Statistical, Bitwise Operators, Linear Algebra, Copying and viewing data in arrays, Stacking, Data Sorting, Data Searching and Indexing, Data counting, Mathematical Operations, Broadcasting, Matrix Operations, Structured Data.

**Self Study:**Fancy Indexing

**Further Reading:**Parallel Processing using Arrays

| UNIT 4 | Data Manipulation | 6 HOURS |
|---|---|---|

**App/System/Case study:**Salary Analysis

**Contents:**Data Loading, Data Storage, Summarizing and Computing Descriptive Statistics, Data Cleaning, Data Preparation, And Data Wrangling: Join, Combine, and Reshape, Data Transformation, Data Aggregation and Group Operations.

**Self Study:**Working on XML and JSON

**Further Reading:**Data Profiling

| UNIT 5 | Data Distribution and Visualization | 6 HOURS |
|---|---|---|

**App/System/Case study:**Sales

**Contents:**Population and Samples

Data Distribution- Statistical Analysis of Data, Data Analytics Techniques; Descriptive, Predictive and Prescriptive, Normal Distribution Significance of Data Visualization in Data Science, Plots- Line Chart, Bar Plot, Histogram, Scatter Plot, Pie Chart, Density Plot, Facet Grids for categorical data, Group Plots

**Self Study:** 3D Visualizations

**Further Reading:**Supervised Learning - Classification-KNN, Regression-Simple Linear Regression

## TEXT BOOK


1. VanderPlas, J. (2016). Python data science handbook: Essential tools for working with data. " O'Reilly Media, Inc.".
2. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".
3. McKinney, W. (2017). Python for data analysis, " O'Reilly Media, Inc".
4. Brownley, C. W. (2016). Foundations for Analytics with Python: From Non-Programmer to Hacker. " O'Reilly Media, Inc.".


## REFERENCE BOOK


1. Mueller, J. P., & Massaron, L. (2019). Python for data science for dummies. John Wiley & Sons.
2. Grus, J. (2019). Data science from scratch: first principles with python. O'Reilly Media.
3. Kane, F. (2017). Hands-on data science and python machine learning. Packt Publishing Ltd.
4. Madhavan, S. (2015). Mastering python for data science. Packt Publishing Ltd.


## E-RESOURCES

1. *https : //onlinecourses.nptel.ac.in/noc22_cs32/preview*

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Essentials of Data Science Lab |
| | COURSE CODE | 2304102L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE :**

**COURSE OBJECTIVES :**

2304102L.CEO.1: To get familiar with the basics of Python programming.
2304102L.CEO.2: To learn different data structures in Data Science.
2304102L.CEO.3: To use data computation methods in Data Science.
2304102L.CEO.4: To introduce data manipulation methods in Data Science.
2304102L.CEO.5: To use data visualization methods in Data Science.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304102L.CO.1: Build a python program for handling syntax and semantics for any given problem[L3].
2304102L.CO.2: Demonstrate proficiency in handling data structures useful in Data Science[L3].
2304102L.CO.3: Apply the suitable methods of data computations on real time data[L3].
2304102L.CO.4: Interpret the different methods of data manipulation on real time data[L3].
2304102L.CO.5: Apply data visualization for real time data to get better insights[L3].

## COURSE ABSTRACT

Essentials of Data Science (EDS) is the First Year Semester-II course. This course aims at equipping learners to be able to provide the essence of Data Science by using python programming. In this course, firstly, the learners will learn python fundamentals required for Data Science. The learners are able to use different data organizational structures to store the real time data. Data computations are required to maintain the quality of data. EDS helps to learn different data computations. Data manipulations help in handling missing and noisy values in Data Processing. The learner will learn data storing, loading, cleaning, preparation, wrangling, transformation etc. Data visualization is the practice of translating information into a visual context, such as a map or graph which tends to identify the patterns, trends from the data. This course will increase the learner's interest in Data Science. The activity based learning is adapted to learn this course.

**PRACTICAL:Perform following experiments using python programming language.**

| **PRACTICAL NO.01** | | **6 HOURS** |
|---|---|---|

**Practice Lab Assignments:**

1. To accept an object mass in kilograms and velocity in meters per second and display its momentum. Momentum is calculated as e=mc2 where m is the mass of the object and c is its velocity.
2. Write a Python program for following conditions.
   If n is single digit print square of it.
   If n is two digit print square root of it.
   If n is three digit print cube root of it.
3. Read the birth date and salary in rupees of employees. Perform data transformation for birthdate to age and also salary which is in rupees to salary in dollars using functions.
4. Print the reverse number of a given number,

**Lab Assignment:**

1. To accept students five courses marks and compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course.
   If student scores aggregate greater than 75 percentage, then the grade is distinction.
   If aggregate is greater than or equal to 60 and less than 75 then the grade if first division.
   If aggregate is greater than or equal 50 and less than 60, then the grade is second division.
   If aggregate is greater than or equal 40 and less than 50, then the grade is third division.
2. Solve the Fibonacci sequence using recursive function in Python.
3. Write a Python program to print different patterns.

**Self Study Assignment:**

Perform all statistical analysis (Average, Max, Min, Sum, on emplyoee data.

| PRACTICAL NO.02 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Perform all List Operations, Dictionary Operations.

**Lab Assignment:**

1. Select the number from the entered list and find its position in Python (use Linear Search).
2. Choose cricket team of eleven players find the captain of the team (consider tallest person as a captain) using dictionary.

**Self Study Assignment:** 1. Consider the student subjects marks are stored in the list. Find the total marks and percentage of students.

2. Perform all tuple operations.

| PRACTICAL NO.03 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Perform all the Numpy operations in python.

**Lab Assignment:**

Prepare/Take dataset for any real life application. Read a dataset into an array. Perform following operations on it as:

- Perform all matrix operations
- Horizontal and vertical stacking of Numpy Arrays
- Custom sequence generation
- Arithmetic and Statistical Operations, Mathematical Operations, Bitwise Operators
- Copying and viewing arrays
- Data Stacking, Searching, Sorting, Counting, Broadcasting

**Self Study Assignment:** For any real life application, perform advanced data operations such as image as array and image manipulations.

| PRACTICAL NO.04 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Perform all the pandas operations in python.

**Lab Assignment:** Read any real life dataset. Store the data into Data Frames. Identify 10 grains for the given dataset. Implement all 20 grains using Pandas methods. The Sample Grains for Sales Dataset as:

- Which was the best month for sales? How much was earned that month?
- Which product sold the most? Why do you think it did?
- Which city sold the most products?
- What Products are most often sold together?

**Self Study Assignment:** For any real life application, perform advanced Data Manipulation operations such as combining data, handling time series data.

| PRACTICAL NO.05 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Install MatPlotLib library. Draw basic graphs for sales dataset using MatPlotLib.

**Lab Assignment:**

For Titanic dataset, Perform data analysis. Identify 5 grains for a given dataset. Perform a data visualization for those grains using the MatPlotLib library. (Use any 5 different graphs with proper title, legends, axis names, etc.to map identified grains)

**Self Study Assignment:** 1. For any real life application, perform advanced graphs for data visu- alization such as Span Selector, Broken Barh-Broken Horizontal Bar plot, Watermarking Images with Matplotlib.

2. Apply Linear Regression and K-Nearest Neighbour Classifier on a real time dataset.

## TEXT BOOK


1. VanderPlas, J. (2016). Python data science handbook: Essential tools for working with data. " O'Reilly Media, Inc.".
2. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".
3. McKinney, W. (2017). Python for data analysis, " O'Reilly Media, Inc".
4. Brownley, C. W. (2016). Foundations for Analytics with Python: From Non-Programmer to Hacker. " O'Reilly Media, Inc.".


## REFERENCE BOOK


1. Mueller, J. P., & Massaron, L. (2019). Python for data science for dummies. John Wiley & Sons.
2. Grus, J. (2019). Data science from scratch: first principles with python. O'Reilly Media.
3. Kane, F. (2017). Hands-on data science and python machine learning. Packt Publishing Ltd.
4. Madhavan, S. (2015). Mastering python for data science. Packt Publishing Ltd.


## E-RESOURCES

1. *https : //onlinecourses.nptel.ac.in/noc22$_{cs}$32/preview*

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY (IT) | COURSE NAME | DATA VISUALIZATION |
| | COURSE CODE | 2308162T |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

## COURSE OBJECTIVES :

2308162T.CEO.1: To introduce students to the fundamental problems, concepts, and approaches in the design and analysis of data visualization systems

2308162T.CEO.2: To familiarize students with the stages of the visualization pipeline, visualization paradigms,techniques, and tools.

2308162T.CEO.3: To Design effective data visualizations in order to provide new insights and communicate information to the viewer.

2308162T.CEO.4: To implement the effectiveness of visualizations for specific data, task, and user types.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308162T.CO.1: Apply Data Exploration, Profiling techniques, cleaning tables on given dataset [L3].

2308162T.CO.2: Identify grains for the given domain [L3].

2308162T.CO.3: Choose appropriate graphs for given grains [L3].

2308162T.CO.4: Construct dashboard and story boards [L3].

## COURSE ABSTRACT:

Data Visualization kingpins exploratory presentation of data. Course direct learner to connect with data, grain identification, data management with the help of filters, data visualization with the help of charts, data analysis with the help of table calculations, and at the end dynamic representation concluding the result with the help of dynamic dashboard and story boards.

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **DATA EXPLORATION** | **06 HOURS** |

**Applications/Case Study: North wind dataset**

**Contents:** Data visualization fundamentals, need for data visualization, Data Exploration, Data profiling, Preprocessing tables and data cleaning, Importance dynamic dashboard, Significance & amp; applications of each graph illustrate with example.

| UNIT 2 | DATA ANALYSIS AND VIEW ENHANCEMENT | 05 HOURS |
|---|---|---|

**Applications/Case Study: Titanic data set**

**Contents:** table calculations,Format worksheet: Font setting, Border, Line, Format specific setting: Number, Field labels, Annotation: Add and Mark, Positioning, Area, Format, Remove, Labels: Display, Show and hide individual mark label, move label. Descriptive analysis and its co-copyrightResize table: Resize entire table, Rows, columns, Cells.

| UNIT 3 | DASHBOARD AND STORY BOARD | 04 HOURS |
|---|---|---|

**Applications/Case Study: Football tournament data set**

**Contents:** Significance and application of each graph, Descriptive analysis and its significance.

**Text book**


1. Sharada Sringeswara; Purvi Tiwari; U. Dinesh Kumar, (2022),"Data Visualization: Storytelling Using Data", Wiley Publication.


**REFERENCE BOOKS**


1. Appala Srinuvasu Muttipati, (2023), " Hand Book on Data Visualization: Easy to quick practices", Notion Press, ISBN: 9798891862920.
2. Joshua N.Milligan. (2015), "Learning Tableau 2020", Packt Publication Limited, ISBN-978-1784391164.


**E - Resources**

1. https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY (IT) | COURSE NAME | DATA VISUALIZATION LAB |
| | COURSE CODE | 2308162L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 20 | 40 |

## COURSE OBJECTIVES :

2308162L.CEO.1: To introduce students to the fundamental problems, concepts, and approaches in the design and analysis of data visualization systems

2308162L.CEO.2: To familiarize students with the stages of the visualization pipeline, visualization paradigms,techniques, and tools.

2308162L.CEO.3: To Design effective data visualizations in order to provide new insights and communicate information to the viewer.

2308162L.CEO.4: To implement the effectiveness of visualizations for specific data, task, and user types.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308162L.CO.1: Apply Data Exploration, Profiling techniques, cleaning tables on given dataset [L3].

2308162L.CO.2: Identify grains for the given domain [L3].

2308162L.CO.3: Choose appropriate graphs for given grains [L3].

2308162L.CO.4: Construct dashboard and story boards [L3].

## COURSE ABSTRACT:

Data Visualization kingpins exploratory presentation of data. Course direct learner to connect with data, grain identification, data management with the help of filters, data visualization with the help of charts, data analysis with the help of table calculations, and at the end dynamic representation concluding the result with the help of dynamic dashboard and story boards.

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **Implement Data connection for the given case study.** | **2 HOURS** |
| - | | |
| **PRACTICAL NO.02** | **Identification of grains for any given application/case study e.g Walmart /supermarket for analysis.** | **2 HOURS** |
| . | | |
| **PRACTICAL NO.03** | **Concepts and demonstration: Implement data management for enhancing customer experience through**<br>1. Filter Addition<br>2. Quick Filters<br>3. Global Filters<br>4. Context Filters<br>5. Sorting<br>6. Grouping | **2 HOURS** |
| . | | |
| **PRACTICAL NO.04** | **Concepts and demonstration: Construct View based on the geographical data visualization with the help of**<br>1. Toolbar<br>2. Dimensions and Measures field<br>3. Folders | **2 HOURS** |
| . | | |

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **Discover basic and advanced view types using**<br>1. Pie charts<br>2. Stacked bar charts<br>3. Histogram<br>4. Line chart<br>5. Area chart<br>6. Scatter plot<br>7. Box and Whisker plot<br>8. Bullet chart<br>9. geographical data charts<br>10. geospatial charts<br>11. tree charts<br>12. heat maps<br>13. pareto charts | **4 HOURS** |
| . | | |
| **PRACTICAL NO.06** | **Concepts and demonstration: Table calculations and measures**<br>1. Addressing and Partitioning table calculations<br>2. Quick table calculations<br>3. Custom table calculations<br>4. Creation of calculated filed<br>5. calculated measures | **4 HOURS** |
| - | | |

| | | |
|---|---|---|
| **PRACTICAL NO.07** | **Concepts and demonstration: create a professional dashboard and story boards by applying**<br>1. Worksheet Formatting<br>2. Format specific setting<br>3. Resize table<br>4. Copy format to other worksheet etc. | **4 HOURS** |
| **PRACTICE ANY 2** | **Concepts and demonstration: create a professional dashboard and story boards on given case study** | **10 HOURS** |

**Text book**

1. Sharada Sringeswara; Purvi Tiwari; U. Dinesh Kumar, (2022),"Data Visualization: Storytelling Using Data", Wiley Publication.

**REFERENCE BOOKS**

1. Appala Srinuvasu Muttipati, (2023), " Hand Book on Data Visualization: Easy to quick practices", Notion Press, ISBN: 9798891862920.
2. Joshua N.Milligan. (2015), "Learning Tableau 2020", Packt Publication Limited, ISBN-978-1784391164.

**E - Resources**

1. https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY (IT) | COURSE NAME | Discrete Structure |
| | COURSE CODE | 2308111T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

## COURSE OBJECTIVES :

2308111T.CEO.1: To learn the basics of set theory and propositional logic.
2308111T.CEO.2: To use appropriate set, function, or relation models to analyze practical examples.
2308111T.CEO.3: To apply the Model and analyze computational processes using combinatorial methods.
2308111T.CEO.4: To explore several logical possibilities and algebraic structures.
2308111T.CEO.5: To understand and solve problems on graphs and trees.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308111T.CO.1: Develop the notion of mathematical thinking, and mathematical proofs in problem analysis [L2].
2308111T.CO.2: Apply propositional logic to elementary mathematical arguments to ensure reasoning [L3].
2308111T.CO.3: Solve problems using Permutations, combinations,relations, and functions [L2].
2308111T.CO.4: Apply the concepts of graphs and trees for problem-solving [L3].

**COURSE ABSTRACT:**

The course will be an introduction to Discrete Mathematics which comprises the essentials for a computer science student to go ahead and study any other topics in the subject. The emphasis will be on problem-solving as well as proofs. The course will provide motivational illustrations and applications throughout the course. The course assumes no prerequisites except for high school-level arithmetic and algebra.

**THEORY COURSE CONTENTS**

| UNIT 1 | BASIC SETS THEORY | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Bank Management System, Online Shopping System: Specialization and Generalization

**Contents:** Sets, Basic operations of sets, Finite and Infinite sets, Principle of Inclusion and exclusion, power sets, countable and uncountable sets. .

**Self Study:** Multi-Sets, Use of Multi Sets

**Further Readings:**Applications of Mathematical Induction

| UNIT 2 | PROPOSITIONAL LOGIC | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Applications of Propositional Logic in AI, Logic Puzzles

**Contents:** Propositional Logic: logic, Propositions, Conditional Propositions, Logical Connectivity, prepositional calculus, Universal and Existential Quantifiers, and Rules of inference.

**Self Study:**Propositional Equivalences.

**Further Readings:**Application of propositional logic in Boolean Algebra, Logic Circuits.

| UNIT 3 | RELATIONS | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Relation between sets and associated functions

**Contents:**Relations: Definition and Properties of Binary Relations, Closure of relations, Warshalls algorithm, Equivalence relations and partitions, Partial ordering relations,Hasse Diagram, and lattices, Chains and Antichains.

**Functions:** Functions, Surjective, Injective and Bijective functions, Composition of functions.

**Self Study:** Application Recurrence Relation for Analysis of Algorithm.

**Further Readings:**Linear Recurrence Relations with Constant Coefficients.

| UNIT 4 | COUNTING METHODS AND THE PIGEONHOLE PRINCIPLE | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Library Management System, Diet Planning System

**Contents:** The Basics of Counting, rule of Sum and Product, Permutations and Combinations , Binomial Coefficients and Combinatorial Identities, and pigeonhole principle.

**Self Study:** Algorithms for generating Permutations and Combinations..

**Further Readings:**Discrete Probability Theory.

| UNIT 5 | ALGEBRAIC STRUCTURES | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Cryptography

**Contents:** Groups theory: Algebraic Systems, Groups, Semi-Groups, Monoids, Subgroups, Permutation Groups, Codes and Group codes, Isomorphism and Auto-morphisms, Homomorphism.

**Self Study:** Euclidean algorithm.

**Further Readings:**Abelian and cyclic groups.

## TEXT BOOKS


1. R. Johnsonbaugh (2009). *Discrete Mathematics*. 5th Edition, Pearson Education, ISBN 817808279- 9 C.
2. Liu and D. P. Mohapatra (2008). *Elements of Discrete Mathematics*. 6th TataMcGraw-Hill,ISBN 10:0-07-066913-9
3. Kenneth H. Rosen (2007). *Discrete Mathematics and its Applications*. 6th McGraw-Hill, ISBN 978-0-07-288008-3


## REFERENCE BOOKS


1. N. Biggs (2002). *Discrete Mathematics*. 3rd Edition, Oxford University Press.
2. E. Goodaire and M. Parmenter *Discrete Mathematics with Graph Theory*. 2nd Edition, Pearson Education.
3. Semyour Lipschutz Marc Lipson *Discrete Mathematics*. 3rd Edition, McGraw-Hill.
4. B. Kolman, R. Busby and S. Ross *Discrete Mathematical Structures*. 4th Edition, Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (English) Lab |
| | COURSE CODE | 2301111L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2301111L.CEO.1: To explain the sounds in English and introduce phonemic transcription.
2301111L.CEO.2: To illustrate the application of fundamental English grammar.
2301111L.CEO.3: To strengthen listening and reading skills with the use of audio and visual aids.
2301111L.CEO.4: To extend the appropriateness of the writing skills in English.
2301111L.CEO.5: To prepare advanced presentations using Canva.
2301111L.CEO.6: To improve communicative competence in English.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301111L.CO.1: Make use of the sounds of English accurately [L3].
2301111L.CO.2: Apply English grammar rules precisely in practical situations [L3].
2301111L.CO.3: Build vocabulary and listening skills using audio-visual aids [L3].
2301111L.CO.4: Develop syntax and texts in English coherently and formally [L3].
2301111L.CO.5: Utilise Canva to improve presentation skills professionally [L3].
2301111L.CO.6: To enhance communicative competence in English [L3].

## COURSE ABSTRACT

The course "Communication Skills: English" primarily focuses on developing communication skills through practical application and utilising language abilities. The objective is to achieve this goal by employing efficient communication and maintaining a constructive demeanour. Students are encouraged to use English as a communication skill to understand speech and body language nuances. This is achieved through activity-based methods and approaches in the language laboratories. The training programme facilitates students' persuasive skills development while fostering improved interpersonal relationships through effective verbal communication. The course enhances students' proficiency and accuracy in communicative competence in English. It enables them to effectively communicate in various contexts, such as society, higher education, and the professional workforce. The course also trains students in using proper practical grammar to enhance effective articulation in English, exploring the primary factors and variables contributing to their difficulties in oral proficiency.

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **Pronunciation and Phonemic Transcription** | **4 HOURS** |
| Identification of correct pronunciation of words by decoding phonemic scripts; writing phonemic transcriptions of the given words. | | |
| **PRACTICAL NO.02** | **Tense and Common Errors** | **6 HOURS** |
| Use of tenses in day to day communication and academic writing. | | |
| **PRACTICAL NO.03** | **Listening Skills** | **4 HOURS** |
| Active listening; Conversations, audio and video clips; Listening with comprehension. | | |
| **PRACTICAL NO.04** | **Vocabulory Enrichment** | **4 HOURS** |
| Online exercises on AWL and NAWL using web-based applications; Dictionary Skills and Common errors in grammar while speaking and writing English. | | |
| **PRACTICAL NO.05** | **Resume, Cover Letter and Email Writing** | **4 HOURS** |
| How to write an email, characteristics and essentials of a good email, resume, formal letter writing and layout of business letters . | | |
| **PRACTICAL NO.06** | **Essay Writing** | **4 HOURS** |
| What is an essay? Tips to write a good essay, Types of essays. | | |
| **PRACTICAL NO.07** | **Report Writing** | **4 HOURS** |
| Types of reports, format and writing a report, what is summarizing? Rules of summarizing. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.08** | **Presentation Skills-Canva** | **6 HOURS** |
| Essentials of effective presentations; Data collection and compilation; Preparation of outlines. | | |
| **PRACTICAL NO.09** | **Group Discussions** | **4 HOURS** |
| Concept of GD, Criteria for evaluation, types of GD – General, Creative and Technical, Dos and Don'ts, Guidelines for participation and success, Group Dynamics, Expression of thoughts and ideas, body language and interpersonal and analytical skills. | | |
| **PRACTICAL NO.10** | **Role Play** | **4 HOURS** |
| Role-play for verbal communication, team building and group dynamics, decision making, leadership, analytical and creative thinking, group presentation. | | |
| **PRACTICAL NO.11** | **Debate** | **4 HOURS** |
| Concept, Dos and Don'ts, Guidelines for participation and success, Expression of thoughts and ideas, body language and interpersonal and analytical skills. | | |
| **PRACTICAL NO.12** | **Persuasive Speaking** | **6 HOURS** |
| Attributes of a good public speaker; prepared and extemporaneous speech; Listening and Reading to famous speeches. | | |
| **PRACTICAL NO.13** | **Reading Comprehension** | **6 HOURS** |
| Techniques of reading- Intensive, Extensive, Skimming and Scanning; Reading Comprehensions. | | |

## REFERENCE BOOKS


1. Ashok Thorat and Munira Lokhandwala: Enriching Oral and Written Communication in English, ISBN 9788125037446.
2. Swan, M. (2005). Practical english usage (Vol. 688). Oxford: Oxford university press.
3. Dutt et.al. : A Course in Communication Skills, Foundation, 1 edition.
4. Peter Roach: English Phonetics and Phonology, 4th Edition, Cambridge, ISBN-0521149215.
5. Lynch: Listening, Cambridge, 1st edition, ISBN- 0521707757.
6. Malcom Goodale: Professional Presentations, Cambridge, ISBN- 8175962577.
7. Aggarwal, S. (2009). Essential communication skills. Ane Books Pvt Ltd.
8. Jennings: Communication Basics, Cengage Learning, 1st edition, ISBN- 8131515206.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (German) |
| | COURSE CODE | 2301112T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2301112T.CEO.1: To introduce German language and enhance knowledge, communication and intellectual capabilities.

2301112T.CEO.2: To extend the appropriateness of writing and speaking skills.

2301112T.CEO.3: To develop ability to respond to simple questions in the German language.

2301112T.CEO.4: To acquire basic vocabulary about daily topics.

2301112T.CEO.5: To improve communicative competence in German.

## COURSE OUTCOMES:

The students after completion of the course will be able to,

2301112T.CO.1: Apply the foundational aspects of grammar and memorize vocabulary [L3].

2301112T.CO.2: Develop comprehension of low to medium difficulty text and practice speaking about every day basic topics [L3].

2301112T.CO.3: Build the basic communication and comprehension skills for conducting day to day business effectively [L3].

2301112T.CO.4: Make use of simple, familiar expressions to interact with native speakers [L3].

2301112T.CO.5: Develop communicative competence in German language [L3].

## COURSE ABSTRACT

The German course not only gives students an excellent grounding in the language, but also opens up fascinating chances to learn more about German culture, history, and literature. Students develop the foundational skills and more advanced strategies necessary to function in a German -speaking culture. A broad variety of linguistic skills, from being able to express oneself properly in writing and speech to being able to understand different forms and talk convincingly in front of an audience of any size, may be honed by learning the language from the bottom up. You may start from scratch with a new language or build on what you already know in this course. Formal education consists of classroom instruction like lectures, seminars, and tutorials. Additionally, students study German through the lens of linked subjects in the fields of history, language, culture, and religion. This German language course is intended for individuals with a high level of linguistic proficiency who want to either deepen their knowledge of the language or begin learning it from scratch.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction and History** | **2 HOURS** |
| **Contents:**Information about Germany, German History, Culture and Language.<br>**Self Study:** Historical perspectives of German language . | | |
| **UNIT 2** | **Greetings and Introduction** | **4 HOURS** |
| **Contents:** Related Vocabulary Alphabets, Numbers, Countries, Languages, Email-Adress, Phone number, Grammar: W-Questions, Simple Sentences, Verb conjugation and personal pronouns like (I, You, He/She/It, We etc.).<br>**Self Study:** Word Formation. | | |
| **UNIT 3** | **Speaking about hobbys, Making an Appointment, Profile in Internet** | **4 HOURS** |
| **Contents:** Numbers (continued), Activity verbs, regular and irregular verbs, Weekdays, Months, Seasons, Professions, Grammar: articles (der, die, das, die) and yes-no-questions.<br>**Self Study:** Oral conversation. | | |
| **UNIT 4** | **City and Sightseeing** | **6 HOURS** |
| **Contents:**Talking about places in a city (railway station, market, bus stop, mall, theatre, cinema hall, museums etc.), Transport (train, bus, plane, tram, metro), Asking for an address or directions, Comprehension: reading city map and events calendar, Grammar: articles in negation (kein, keine, kein, keine), Imperative sentences with you.<br>**Self Study:** Regional information in Germany. | | |
| **UNIT 5** | **Food** | **4 HOURS** |
| **Contents:**Fruits, Vegetables, Drinks, Meals, shops, Grocery shopping, Grammar: Accusative case.<br>**Self Study:** Cultural Food in Germany. | | |

| UNIT 6 | Time | 6 HOURS |
|---|---|---|
| **Applications/Case Study:**German Translation.<br>**Contents:**Talking about time, asking for time, Making an appointment (part 2), Daily routine, Telephone and email conversations, Grammar: Modalverbs, posessive articles (my, your. . . ).<br>**Self Study:** Time keeping formats. | | |
| **UNIT 7** | **Revision** | **4 HOURS** |
| **Applications/Case Study:** German Translation.<br>**Contents:** Reading and comprehension, Writing, Listening (optional), Speaking. | | |

## TEXT BOOKS

1. Netzwerk Deutsch als Fremdsprache- Kursbuch A1( Stefanie Dengler), Goyal Publications.

## REFERENCE BOOKS

1. https://www.klett-sprachen.de , https://www.duolingo.com/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (Japanese) |
| | COURSE CODE | 2301113T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301113T.CEO.1: To introduce Japanese as a foreign language and enhance knowledge, communication and intellectual capabilities which helps to improve cognitive skills and creativity vital for problem solving and innovation.

2301113T.CEO.2: To develop an awareness of Japanese culture along with providing better career opportunities later in life.

2301113T.CEO.3: To develop ability to respond to simple questions in the Japanese language.

2301113T.CEO.4: To acquire basic vocabulary about daily topics in Japanese language.

2301113T.CEO.5: To develop skills related to reading simple sentences and understanding uncomplicated dialogues.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301113T.CO.1: Develop communication and comprehension skills for conducting day-to-day business effectively

2301113T.CO.2: Understand typical every day and job-related expressions and sentences in the written format.

2301113T.CO.3: Use simple, familiar expressions and produce main ideas of familiar topics when interacting with native speakers or when visiting Japan.

2301113T.CO.4: Develop basic terminology regarding everyday themes in Japanese.

2301113T.CO.5: Hone abilities in reading easy-to-follow words and comprehending straightforward conversations.

## COURSE ABSTRACT

Learning Japanese gives students a firm grasps of the language as well as a window into Japanese society, history, and literature. Students acquire both the basic and advanced skills necessary to function effectively in a Japanese-speaking culture. Starting from scratch with a language is the best way to develop fluency in all aspects of communication, from reading and writing to speaking in front of large groups with ease. The course is designed to help students learn a new language and improve their existing skills. To acquire knowledge, students participate in classroom activities such as lectures, seminars, and tutorials. In addition, they study Japan and its culture from a variety of angles, including its history, language, culture, and religion. This course is intended with a high level of linguistic proficiency who wants to either expand their knowledge of Japanese or begin learning it from scratch.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction** | **3 HOURS** |
| **Contents:** Information about Japan, Japanese History, Culture and Language.<br>**Self Study:** Japanese Background . | | |
| **UNIT 2** | **Greetings, Self Introduction, Japanese Script** | **6 HOURS** |
| **Contents:**Self-Introduction- Jikoshoukai, Greeting Words, Hiragana Series, Simple vocabulary in Hiragana.<br>**Self Study:**Introduce yourself. | | |
| **UNIT 3** | **Understanding Japanese Script** | **4 HOURS** |
| **Contents:** Katakana Series, Simple vocabulary in Katakana, Introduction of the concept of time .<br>**Self Study:** Japanese script. | | |
| **UNIT 4** | **Understanding Simple Sentence Patterns, Time, Prices, Adjectives** | **5 HOURS** |
| **Contents:** Basic sentence pattern, Use of demonstrative pronouns, Numbers, Expressing time, Asking for / telling prices, Adjectives.<br>**Self Study:** Grammatical Components. | | |
| **UNIT 5** | **Date, Verbs, Directions, Binding Sentences** | **6 HOURS** |
| **Contents:** Dates, time, frequencies, Verbs in the present and past tense, Coming/Going to, Binding and building longer sentences.<br>**Self Study:** Binding sentences. | | |
| **UNIT 6** | **Amounts of Time/Money, Distance, Describing Existence, Counters** | **6 HOURS** |
| **Applications/Case Study:**German Translation.<br>**Contents:**Asking/Telling the amount of time and money, Going from/to, Describing the existence/non-existence of something, Counters.<br>**Self Study:** Describing existence. | | |

## REFERENCE BOOKS


1. Introduction to Nihongo- Haru 1- Maharashtra State Bureau of Textbook Production and Curriculum Research.
2. Minna No Nihongo-1-1 Japan Foundation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (French) |
| | COURSE CODE | 2301114T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2301114T.CEO.1: To introduce French language and enhance knowledge, communication and intellectual capabilities.

2301114T.CEO.2: To extend the appropriateness of writing and speaking skills.

2301114T.CEO.3: To develop ability to respond to simple questions in the French language.

2301114T.CEO.4: To acquire basic vocabulary about daily topics

2301114T.CEO.5: To improve communicative competence in French.

## COURSE OUTCOMES:

The students after completion of the course will be able to,

2301114T.CO.1: Apply the foundational aspects of grammar and memorize vocabulary [L3].

2301114T.CO.2: Develop comprehension of low to medium difficulty text and practice speaking about every day basic topics [L3].

2301114T.CO.3: Build the basic communication and comprehension skills for conducting day-to-day business effectively [L3].

2301114T.CO.4: Make use of simple, familiar expressions to interact with native speakers [L3].

2301114T.CO.5: Develop communicative competence in French language [L3].

## COURSE ABSTRACT

The French course provides students with a solid foundation in the language and opportunities to delve further into a foreign culture, history, and literature. Students learn the fundamentals and advanced techniques they need to succeed in a society where French language is spoken. Learning the language from the ground up helps hone a wide range of linguistic abilities, from expressing yourself clearly in speaking and writing to comprehending various formats to confidently address an audience of any size. The course provides with the option to learn a language from the ground up or to expand on any prior knowledge of the language. Students learn through formal training, lectures, seminars, and tutorials. In addition, they pursue a curriculum in French studies through related themes in historical, linguistic, cultural, religious, and other settings. The French course is designed for students with advanced language abilities to deepen their mastery of a foreign language or begin studying it from scratch.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction** | **5 HOURS** |
| **Contents:** Vous connaissez la France ? - Introduction.<br>**Self Study:** Spoken task -record an audio. | | |
| **UNIT 2** | **Presentation and Questioning** | **5 HOURS** |
| **Contents:** Autour de moi- Presenting and questioning Nouns.<br>**Self Study:** Written task- forming questions and exercises. | | |
| **UNIT 3** | **Syntax** | **5 HOURS** |
| **Contents:** Le monde- Sentence structure, talking about oneself, countries, cities ,etc.<br>**Self Study:** Written task- form sentences about oneself, countries, cities ,etc. | | |
| **UNIT 4** | **Speaking and Writing Skills** | **5 HOURS** |
| **Contents:**Ma famille- writing and talking about :Family, house and time.<br>**Self Study:** Written task- form sentences about one's family and house. | | |
| **UNIT 5** | **Writing Task** | **5 HOURS** |
| **Contents:** Mes loisirs- writing and talking about :Hobbies.<br>**Self Study:** Written task- form sentences using different verbs and talk about one's hobbies. | | |
| **UNIT 6** | **Spoken and Written Daily Routine** | **5 HOURS** |
| **Contents:** Ma routine- writing and talking about : daily activities, seasons and one's body.<br>**Self Study:** Written task- form sentences about one's daily routine and seasons. | | |

## TEXT BOOKS

1. Saison 1(unit 1-6)- Didier.

## REFERENCE BOOKS

1. Extracts from: Alter Ego 1, En Echanges, Entre jeunes, Apprenons le franc¸ais.
2. Worksheets.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Creative Technologies Lab |
| | COURSE CODE | 2307183L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2307183L.CEO.1: Develop insight for Futuristic Technology Development.
2307183L.CEO.2: Become familiar with Digital Technologies like AI, AR, Block chain, Cloud, IOT
2307183L.CEO.3: Explore various developments in Robotics, EV, Drone and AE/CE, ZEB.
2307183L.CEO.4: Build a solution for real life problem based on futuristic technologies
2307183L.CEO.5: Design and Develop a Digital Portfolio using Web Technology

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2307183L.CO.1: Articulate the significance of United Nations Organization (UNO) Goals. [L2]
2307183L.CO.2: Develop a Digital Portfolio using Web Technology. [L3]
2307183L.CO.3: Illustrate the use cases of emerging technologies. [L2]
2307183L.CO.4: Develop a Laboratory project based on future technologies in a team. [L3]

## COURSE ABSTRACT

This is compulsory course with choice-based modules aims to focus on introduction to the futuristic developing engineering technologies. The students will gain insight to technology development and multidisciplinary industrial environment at introductory level. The students will comprehend different technologies in instructional interaction. They will develop Digital portfolio using Web Technology. The students will have ample choice to select futuristic technology of their interest. In order to experience joyful learning, students will apply chosen futuristic technology for real life problems. Alongside demonstrations and there will be hands on training on chosen futuristic technology. They will develop a laboratory project based on futuristic technologies Like Artificial Intelligence (AI), Generative AI (GenAI) and Prompt Engineering, Block-chain Technology, Electric Vehicles (EV), Internet of Things (IOT), Cloud Computing, Augmented Reality (AR), Robotics and Drones, Zero Energy Building (ZEB) and Affordable and Clean Energy (AE/CE).

**PRACTICALS:**

**Module 1: INSTRUCTIONAL MODULE (16 HOURS) [COMPULSORY]**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Sustainable Technology Development** | **1 HOURS** |

Need for Technology, Overview of Technology Development. Advanced Technologies by year 2030, UNO Goals, Priorities, Open problems, Sustainable Technology.

**Application/Case Study:** Zero Hunger (UNO Goals: Sustainable Development Goal 2).

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Digital Portfolio** | **1 HOURS** |

Significance of digital portfolio, Methods for making effective digital portfolio.

**Application/Case Study:** Sample Digital portfolios of students and Professionals.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Futuristic Technologies** | **7 HOURS** |

Introduction to Artificial Intelligence & Machine Learning, Generative AI, Prompt Engineering, Types of Learnings. Basics of Big Data, significance of it. Introduction to Internet of things, IoT overview, Concept of Edge Computing, IOT Edge computing solutions. Need and importance of Cyber Security, Aspects of cyber-Security.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Overview of Emerging technologies** | **7 HOURS** |

Digital Technology Domain: Introduction to Block-chain technology, Fundamental concepts of Cloud computing, Concept of Augmented Reality and applications.

Industry Automation Domain: Introduction to Robotics and Automation, Robot classification, Robot anatomy, Introduction to Drone, Anatomy of a Customized Drone Technology.

Renewable Energy Domain: Solar, Wind, Biofuels, Energy types of fuel cell. Electrical Vehicle (EV), Overview of different systems in EV, Types, Concept of Zero Energy Building (ZEB), Comparison ZEB and Green building, Net zero site energy use, Net zero site source energy use, Net zero energy emissions, Net zero cost Application

| Module 2: WEB TECHNOLOGY MODULE (14 HOURS) [COMPULSORY] | | |
|---|---|---|
| **PRACTICAL NO.01** | **Basic HTML** | **4 HOURS** |
| Web , , 3.0, 4.0, Basic html tags, formatting tags, color tags, Div and span tags , Ordered list, Unordered list, Image tags, URL tag, table , Form, Hyperlinks. | | |
| **PRACTICAL NO.02** | **Cascading Style Sheets-CSS** | **4 HOURS** |
| Cascading Style Sheets-CSS, Multiple style sheets, Web page Layout and website Designs. | | |
| **PRACTICAL NO.03** | **Digital Portfolio** | **6 HOURS** |
| One-page/multi-page portfolio using HTML, Projection of information, Personal information, Projects, Achievements, Contact details etc. | | |

| Module-3 ADVANCED TECHNOLOGY MODULE* (16 HOURS) [CHOICE BASED] | | |
|---|---|---|
| * Student will select any one module out of Elevan | | |
| **MODULE NO.3A** | **Artificial Intelligence (AI)** | **16 HOURS** |
| PRACTICAL-1 | Introduction to AI | 02 HOURS |
| PRACTICAL-2 | Image Processing-Object Recognition | 04 HOURS |
| PRACTICAL-3 | Machine Learning- Classification/Prediction | 04 HOURS |
| LAB PROJECT | Lab Project based on AI Application | 06 HOURS |
| **MODULE NO.3B** | **Prompt Engineering for Generative AI** | **16 HOURS** |
| PRACTICAL-1 | Introduction to Generative AI & Prompt Engineering (Basic prompting to Build Generative AI Application) | 02 HOURS |
| PRACTICAL-2 | Designing Prompts for Different Tasks, Prompt Engineering Techniques - N-Shot, Zero Shot and Few Shot Prompting | 04 HOURS |
| PRACTICAL-3 | Content Generation with Prompts (Strategies for generating text, image using prompt) | 04 HOURS |
| LAB PROJECT | Lab Project based on Prompt Engineering for real world prob-lems | 06 HOURS |
| **MODULE NO.3C** | **Block Chain Technology** | **16 HOURS** |
| PRACTICAL-1 | Introduction to Block Chain | 02 HOURS |
| PRACTICAL-2 | Development and Deployment of smart contact | 04 HOURS |
| PRACTICAL-3 | Creation of contact users | 04 HOURS |
| LAB PROJECT | Lab Project based on Block Chain Technology | 06 HOURS |

| MODULE NO.3D | Cloud Computing | 16 HOURS |
|---|---|---|
| PRACTICAL-1 | Creation of AWS account, Service models | 02 HOURS |
| PRACTICAL-2 | Deployment and configuration management | 04 HOURS |
| PRACTICAL-3 | AWS instance on AWS cloud, Deployment of web server | 04 HOURS |
| LAB PROJECT | Lab Project based on Cloud Computing Technology | 06 HOURS |
| **MODULE NO.3E** | **Augmented Reality** | **16 HOURS** |
| PRACTICAL-1 | Introduction to Augmented Reality | 02 HOURS |
| PRACTICAL-2 | Objects, Physics, Light intensity adjustments, Scripts | 04 HOURS |
| PRACTICAL-3 | Development of 3D project and building application | 04 HOURS |
| LAB PROJECT | Lab Project based for Augmented Reality | 06 HOURS |
| **MODULE NO.3F** | **Internet of Things (IOT)** | **16 HOURS** |
| PRACTICAL-1 | Hardware and Software Simulation Environment, Sensor and Actuators | 02 HOURS |
| PRACTICAL-2 | Switch Networking with WiFi module | 04 HOURS |
| PRACTICAL-3 | IoT, Cloud Platforms for IOT | 04 HOURS |
| LAB PROJECT | Lab Project based on IOT | 06 HOURS |
| **MODULE NO.3G** | **Robotics** | **16 HOURS** |
| PRACTICAL-1 | Introduction Components, types components | 02 HOURS |
| PRACTICAL-2 | Sensors, Actuators, Controller and Circuit | 04 HOURS |
| PRACTICAL-3 | Block code | 04 HOURS |
| LAB PROJECT | Lab Project based Robotics | 06 HOURS |

| MODULE NO.3H | Drone Technology | 16 HOURS |
|---|---|---|
| PRACTICAL-1 | Battery, Motors, BLDC, Power rating, losses | 02 HOURS |
| PRACTICAL-2 | Flight controllers, Pixhawk, Mamba Controllers | 04 HOURS |
| PRACTICAL-3 | Propellers, Assembly | 04 HOURS |
| PROJECT | Lab Project based on Drone Applications | 06 HOURS |
| **MODULE NO.3I** | **Affordable and Clean Energy** | **16 HOURS** |
| PRACTICAL-1 | Proton Exchange Membrane Fuel cell | 02 HOURS |
| PRACTICAL-2 | Microbial Fuel cell | 04 HOURS |
| PRACTICAL-3 | Open air cathode type fuel cell for car | 04 HOURS |
| LAB PROJECT | Lab Project for Affordable and Clean Energy | 06 HOURS |

| MODULE NO.3J | Electric Vehicles | 16 HOURS |
|---|---|---|
| PRACTICAL-1 | EV Motors and controllers, Battery pack | 02 HOURS |
| PRACTICAL-2 | Assembly and Working of Two-Wheeler EV | 04 HOURS |
| PRACTICAL-3 | Field Visit to Charging Station | 04 HOURS |
| LAB PROJECT | Lab Project for Electric vehicles | 06 HOURS |
| **MODULE NO.3K** | **Zero Energy Building** | **16 HOURS** |
| PRACTICAL-1 | Calculation of Carbon Footprint, Greenness | 02 HOURS |
| PRACTICAL-2 | Calculation of Electricity bill of Family / Hostel/ College Buildings | 04 HOURS |
| PRACTICAL-3 | Build It Green (PPT/ Video Presentation) | 04 HOURS |
| LAB PROJECT | Model Making | 06 HOURS |

**Continuous Assessment (CA) (35 Marks)**

1. Activity on Sustainability (05 Marks)
2. Activity on Uno goals (10 Marks)
3. *Certification with Online/Offline/Hybrid Course on Future Skills or Future Technologies (20 Marks)

***Certifications [Compulsory for every student]**

1. An Industrial or Academic certification course from Industries Agencies of repute will award 20 Marks.
2. The applicable Certification courses will be announced before the start of semester. The students must register for these courses and complete within the time frame announced.
3. The Institute is having collaborations with different agencies like NASSCOM, IBM, IUCEE etc. The applicable courses will be informed to the students.

**Laboratory Assessment (PR): (40 Marks)**

**Jury (Laboratory Project and Assignment Presentation Exam)**

1. Lab Experiments, Continuous Assessment activities as applicable in respective Modules (10 Marks).
2. Model Making, Poster presentation, Technical Article, Blog, Physical System Development (Basic) etc. activities as applicable in respective Modules (15 Marks).
3. Presentation of Digital portfolio- Presentation of all assignments and activities in the portfolio. (Personal Website). (15 Marks).

## TEXT BOOKS


1. Solem, J. E. (2012). Programming Computer Vision with Python: Tools and algorithms for analyzing images. " O'Reilly Media, Inc.".
2. Vinod Chandra S.S., Hareendran A. S. (2014) Artificial Intelligence and Machine Learning. Prentice Hall India Learning Private Limited.
3. Hoff, T. (2017) Explain the cloud like I'm 10: Learn the inner-secrets behind Kindle, Netflix, AWS, Apple, Facebook, and Google. United States: Possibility Outpost Inc.
4. Garren A. (2017). AWS: A Beginner's Guide to the Basics of Amazon Webservice.
5. Soni, V. (2022). IOT for beginners: Explore IOT architecture, working principles, IOT devices, and various real IOT projects. Inde (BPB Publications).
6. Ford, M. (2016). Rise of the robots: Technology and the threat of a jobless future. Basic Books.
7. Yasodharan R. (2016). Basics of Robotics: To know all about Robotics. (Online).
8. Davies, B. (2016). In Build a drone: A step-by-step guide to designing, constructing, and flying your very own drone. essay, Skyhorse Publishing.
9. Abell, T. (2017). All about drones (Cutting-Edge Technology). North Star Editions.
10. Sandvik, K. B., & amp; Jumbert, M. G. (2016). The good drone (Emerging Technologies, Ethics and International Affairs). Routledge.
11. Liljequist, B., McLennan, F. (2016). The power of Zero: Learning from the world's leading Net Zero Energy Buildings. Ecotone Publishing.
12. Liu H. (2006). Principles of Fuel Cells. Taylor & Francis.
13. Patel N. (Editor). (2021). Electric Vehicles: Modern Technologies and Trends. Springer.
14. Miles M. (2022). The future in AR (augmented reality) for beginners. Online.

## REFERENCE BOOKS


1. UNITED NATIONS. (2021). Technology and innovation report 2021: Catching technological waves . United Nations Publications. https://unctad.org/system/files/official-document/tir2020_en.pdf.
2. Burrows, M. (2012). Global trends 2030: Alternative worlds. US National Intelligence Council. https://www.dni.gov/files/documents/GlobalTrends_2030.pdf.
3. Open-source reference examples of digital portfolio. https://github.com/smaranjitghose/awesome-portfolio-websites https://www.freecodecamp.org/news/how-to-build-a-developer-portfolio-website/

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

# MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# Second Year

# Bachelor of Technology

# Information Technology

## NEP REVISION 2023 ()

(With Effect from Academic Year: )

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| SECOND YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

**SEMESTER: III (INFORMATION TECHNOLOGY)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2308211T | Data Communication | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2308211L | Data Communication Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2308212T | Data Structures | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| PCC | 2308213T | Computer Graphics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| PCC | 2308214L | Programming Lab | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| VSEC | 2308261L | Problem Solving Using OOP(C++) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2308262L | Problem-Solving Using OOP(Java) | | | | | | | | | | |
| HSSM VEC | 2301286T | Environmental Science | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| HSSM VEC | 2301287 | Universal Human Values-II | 1 | 4 | - | - | - | 25 | - | 75 | 100 | 3 |
| HSSM MEC | 2301276 | Entrepreneurship Skills | 1 | 2 | - | - | - | 25 | 20 | 30 | 75 | 2 |
| ELC PRJ | 2308291L | Project Design | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ELC SI | 2308296L | Internship (Life And Soft Skills) | - | - | - | - | - | - | - | 75 | 75 | 2 |
| **TOTAL** | | | **11** | **18** | | | | | | | **825** | **22** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| SECOND YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

**SEMESTER: IV (INFORMATION TECHNOLOGY)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | CREDIT |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2308216T | Database Management System | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2308216L | Database Management System Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2308219T | Advanced Data Structures | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2308219L | Advanced Data Structures Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2308220T | Theory of Computation | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| VSEC | 2308268L | Object Oriented Programming (Core Java) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2308269L | Enterprise Application Development (Advance Java) | | | | | | | | | | |
| MDM | *MDM List | MDM Course-I | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | *MDM List | MDM Course-I Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| OE | 2301254T | Open Elective (Applied Maths) | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301254L | Open Elective (Applied Maths) Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| OE | 23BD251L | Prototyping | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 23XX25X | Open Elective | 2 | - | - | 35 | - | 40 | - | - | | |
| ELC PRJ | 2308292L | Project Implementation | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| Audit | 2301281A | Indian Constitution | 1 | - | - | - | - | - | - | - | Audit | |
| TOTAL | | | 16 | 18 | - | | | | | | 850 | 22 |

*Two Credit Internships need to be completed after Completion of the Second Year.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Data Communication |
| | COURSE CODE | 2308211T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE KNOWLEDGE:** Basics of Computer Knowledge

## COURSE OBJECTIVES :

2308211T.CEO.1: To build understanding of fundamental concepts of data communication.
2308211T.CEO.2: To differentiate between different types of media.
2308211T.CEO.3: To classify digital codes for different networking applications.
2308211T.CEO.4: To explore types of modulation techniques.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308211T.CO.1: Identify data communication type for network infrastructure. [L3].
2308211T.CO.2: To make use of suitable transmission media for network application. [L3]
2308211T.CO.3: Apply digital encoding and decoding techniques to real-world communication systems.[L3]
2308211T.CO.4: Summerize best suitable modulation scheme and multiplexing method for real time applications.[L4]

## COURSE ABSTRACT:

Data Communication is a course designed to provide students with a comprehensive understanding of how data is transmitted and received in various types of networks and communication systems. This course covers the fundamental principles of data communication, including the technologies, protocols, and hardware involved in the transfer of data over different communication mediums.The Data Communication course provides an in-depth exploration of the principles and technologies that facilitate the transmission of data over various communication systems. Students will gain a solid understanding of how data are encoded, transmitted, and received through variouss communication channels.

## THEORY COURSE CONTENTS

| UNIT 1 | Introduction to Data Communication | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Email Communication

**Contents:** Basic concepts, definitions, and components of data communication.Types of data communication: simplex, half-duplex, and full-duplex.Data transfer modes: serial and parallel communication,The Role of Telecommunications in Networking-The Local Loop,LANs,MANs and WANs,Major criteria Data Communication Network,Modem -Basic Definition,Digital Connection, Analog Connection,External/Internal Modems,Modem Types Features of Modems.

**Self Study:** Telecommunication Systems,Television and Broadcasting.

**Further Readings:** Wireless Communication.

| UNIT 2 | Transmission Media | 10 HOURS |
|---|---|---|

**Applications/Case Study:** CCTV,DTH,Telecommunication systems .

**Contents:** Introduction,Types of Transmission Media, Guided Transmission Media-Open Wire,Twisted Pair,Coaxial Cable,Optical Fibre,Unguided Transmission Media-RF Propagation,Radio Frequencies,Microwave,Satellite,Iridium Telecom System,RS-232D Flow Control -Hardware Handshaking,Hardware Null Modems,Software Handshaking Xon/Xoff,Software Null Modem,Terminals PCs,RS-232D Serial Interface Standard.

**Self Study:** Web and internet,Virtual telephony.

**Further Readings:** Remote communication,HTTP,TCP.

| UNIT 3 | Digital Codes and Communications | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Digital Identification and Authentication .

**Contents:** Standard Digital Codes:Extended Binary Coded Decimal Interchange Code(EBCDIC),American Standard Code for Information Interchange(ASCII),Voice Channel Communications,Telephone Networks, Plain Old Telephone Set(POTS),Local Loops,Central Office,Hierarchical Phone Networks,Telephone Line Characteristics,Line Impairments,Crosstalk,Echo or Signal Return,Frequency Shift,Non-Linear Distortion.Jitter: Amplitude and Phase,Transients: Impulse Noise, Gain Hits, Dropouts Phase Hits).

**Self Study:** Encoding data,Decoding data,BIT,BYTE.

**Further Readings:** Satellite and Space Communications .

| UNIT 4 | Modulation and Multiplexing | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Radar Systems,Digital Broadcasting .

**Contents:** Modulation Techniques: Amplitude Modulation(AM),Frequency Modulation(FM),Phase Modulation(PM),Modem Modulation:Frequency Shifted Keying(FSK),Quadrature Phase Shifted Keying(QPSK),Quadrature Amplitude Modulation(QAM),Multiplexing:Frequency Division Multiplexing (FDM),Time Division Multiplexing (TDM),Statistical Time Division Multiplexing (STDM)),Telecommunication Multiplexing(FDM - Channel Groups,TDM - T1 Carrier System).

**Self Study:**Orthogonal Frequency Division Multiplexing (OFDM), Filter Bank Multi-Carrier (FBMC)

.

**Further Readings:** Generalized Frequency Division Multiplexing (GFDM), and Index Modulation (IM) .

## TEXT BOOKS


1. William Stallings*Data Communications and Networking with TCPIP Protocol Suite*. 6$^{th}$ Edition.2022, ISBN 9355320949.
2. William Stallings*Data Communications and Networking*. 10$^{th}$ Edition.2017, ISBN 978-0135508488.
3. TOMASI *Introduction to Data communication and Networking*. 1$^{st}$ Edition.2007, ISBN 9788131709306.


## REFERENCE BOOKS


1. Fred Halsall. *Introduction to Data Communications and Networking*. 4$^{th}$ Edition,1985,ISBN 978-0132837901.
2. Behrouz A. Forouzan. *Data Communications and Networking*. 5$^{th}$ Edition,2012,ISBN- 978-0073376226.


## E-RESOURCES

1. https://www.coursera.org/specializations/computer-communications
2. https://www.netacad.com/courses/network-security?courseLang=en-US

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Data Communication Lab |
| | COURSE CODE | 2308211L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Basics of Computer Knowledge

## COURSE OBJECTIVES :

2308211L.CEO.1: To demonstrate appropriate use of communication media.
2308211L.CEO.2: To explore various communication channels.
2308211L.CEO.3: To explore types of modulation techniques.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308211L.CO.1: Apply communication channels for data transmission.[L3]
2308211L.CO.2: Construct binary and decimal system for data communication in network. [L3].
2308211L.CO.3: Analyze different modulation techniques for signal transmission. [L4].

**COURSE ABSTRACT:**

The Data Communication Lab is designed to provide students with hands-on experience in the fundamental concepts and technologies used in modern data communication and networking. This laboratory course focuses on the practical application of various communication protocols, transmission technique and networking devices. Through a series of experiments, students will gain exposure to the real-world implementation of data communication systems and network configuration.The course covers topics such as analog and digital transmission, modulation techniques.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Set up a wired LAN using a Layer 2 switch, connecting a minimum of four computers. The setup process includes preparing network cables, testing them with a line tester, configuring the computers with appropriate IP addresses, and verifying connectivity using the PING utility. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Write a C/C++ program communication with a serial port using the RS-232D standard. | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Write a C/C++ program to convert a Binary to Decimal and vice versa. | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Write a C/C++ program to check keyboard key presses and display their corresponding ASCII values in real-time. | | |
| **PRACTICAL NO.05** | | **2 HOURS** |
| Implement a C/C++ program for Pulse Modulation(PM)/Amplitude modulation (AM)/Frequency modulation (FM). | | |
| **PRACTICAL NO.06** | | **2 HOURS** |
| Implement a C/C++ program for Frequency-shift keying (FSK)/Amplitude-shift keying (ASK)/Phase-shift keying (PSK). | | |
| **PRACTICAL NO.07** | | **2 HOURS** |
| Implement a C/C++ program for Pulse code modulation(PCM). | | |
| **PRACTICAL NO.08** | | **2 HOURS** |

| Implement a C/C++ program for Frequency Division Multiplexing(FDM)/Time Division Multiplexing (TDM)/ Statistical Time Division Multiplexing (STDM). | | |
|---|---|---|
| **MINI PROJECTS** | | **06 HOURS** |

Mini Project Guide Lines

1. Maximum 3 students allowed in each group.
2. Each group will work on design and Implementation.
3. Students should submit the report in soft copy and hard copy.

## TEXT BOOKS


1. Stallings William. *Data and Computer Communications*. 10th ISBN 9789332586932 .
2. T Evanson *Network+ Lab Manual*. 10th ISBN 0782126413


## REFERENCE BOOKS


1. Cisco Systems Inc. (Author), Cisco Networking Academy Program (Author). *Fundamentals of Voice and Data Cabling Lab Companion*. 3rd ISBN-1587130882.
2. Richard M. Roberts (Author), Ola Jobi (Author). *Networking Fundamentals*. 3rd ISBN-1635634458.


## E-RESOURCES

1. https://www.coursera.org/specializations/computer-communications
2. https://www.netacad.com/courses/network-security?courseLang=en-US

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | DATA STRUCTURES |
| | COURSE CODE | 2308212T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** Knowledge of Fundamentals of Computing

## COURSE OBJECTIVES :

2308212T.CEO.1: To explain fundamental data structures and their applications in programming and problem solving.
2308212T.CEO.2: To illustrate abstract data representation methods.
2308212T.CEO.3: To build the ability to synthesize and analyze algorithms.
2308212T.CEO.4: To explain effective management of linear data structures.
2308212T.CEO.5: To demonstrate various techniques of searching and sorting.
2308212T.CEO.6: To build the ability to identify appropriate data structure for the specified problem.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308212T.CO.1: Explain the working of linear data structures. [L2].
2308212T.CO.2: Apply concept of Arrays for developing various applications.[L3].
2308212T.CO.3: Choose suitable type of linked list for solving problems.[L3].
2308212T.CO.4: Make use of Stack and Queue for scenario based applications.[L3].
2308212T.CO.5: Apply appropriate searching and sorting algorithm to solve real world problems. [L3].
2308212T.CO.6: Implement the concepts of hashing for solving real world problems. [L3].

## COURSE ABSTRACT:

The basic aim of the course is to provide the knowledge of organizing and managing the data in the system. The goal is to make students understand the concept of data organization, management, abstraction, re-usability and efficient processing to retrieve useful information. Fundamentals of primitive data structures, various operations and related algorithms, applicability of data structures in real time applications are all covered in the syllabus.

## THEORY COURSE CONTENTS

| UNIT 1 | INTRODUCTION TO DATA STRUCTURES | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Social networking, Recommendation system , Map applications.

**Contents:** Introduction to data structures, data objects, Abstract Data Types (ADT). Classification of data structures: - linear and Non-linear, static and dynamic, persistent and ephemeral data structures. Introduction to algorithms, Characteristics, Design Strategy (Introduction): - Greedy, Backtracking Divide Conquer, Dynamic Programming, Branch and Bound, Brute Force and Randomized Algorithm. Algorithmic complexities: - time and space complexity (iterative and recursive algorithms), Classification of algorithmic complexities (constant, linear, quadratic, cubic, exponential and factorial). Efficiency of algorithms, Big O, theta and omega notations with its significance. Introduction to Array: - Sequential Organization, Array as ADT, Representation and address calculation. Multidimensional Array, Operations on Array, Polynomial Representation and Sparse Matrix Representation.

**Self Study:-** Arrays in Image Processing.

**Further Readings:-** Arrays in Game Playing, Array and Database.

| UNIT 2 | LINKED LIST | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Process management in Linux, Account Management System, Shuffle merging system for set of two integer sets

**Contents:** Introduction to Linked lists, Linear Data Structure using linked Organization, Comparison of sequential and linked list organizations Linked List as ADT, Types:- Singly linked list, Doubly linked list, Singular and Doubly Circular linked list). Memory representation of linked list. Operations on linked list: insertion, deletion, traversing, searching, concatenation, merging and sorting, Polynomials Representation: - Ordered List, Polynomial Addition Multiplication. Generalized Linked List (GLL) :- concept, representation of polynomial and sets using GLL.

**Self Study:-** Garbage collection and linked list

**Further Readings:-** Web indexing using linked list

| UNIT 3 | STACK | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Josephus problem.

**Contents:** : Introduction to Stack, Stack as ADT, Representation and implementation of stack using array and Linked List, Multiple Stacks. Operations on stack, Applications: - Expression Evaluation and Conversion. Recursion: - Concept and Variants, Application: Tower of Hanoi. Backtracking:- Concept and use of stack in Backtracking, Application: 8-Queens Problem.

**Self Study:-** Role of stack in memory management.

**Further Readings:-** Concept of Back Stack.

| UNIT 4 | QUEUE | 08 HOURS |
|---|---|---|

**Applications/Case Study:** CPU Schedulong, Syntax checker system for matching braces, Maze solving system.

**Contents:** Introduction to Queue, Queue as ADT, Types: - Linear, Circular, Doubly-ended and Priority Queue. Representation and implementation of queue using array and linked list, Operations on Queue, Multiple Queues.

**Self Study:-** Concurrent Priority Queues.

**Further Readings:-** Bandwidth Management and Data Compression using Priority Queue.

| UNIT 5 | SEARCHING AND SORTING TECHNIQUES | 07 HOURS |
|---|---|---|

**Contents:** Searching:- Linear Search, Binary Search, Fibonacci Search and Sentinel Search.

Sorting: - Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Radix Sort and Shell Sort.

**Self Study:-** Bucket Sort.

**Further Readings:-** Tim Sort.

| UNIT 6 | HASHING TECHNIQUES | 06 HOURS |
|---|---|---|

**Contents:** Hash table and hash map, hash function, bucket, collision, probe, overflow, open hashing, closed hashing, perfect hash function, load density, full table, load factor, rehashing.

hash functions :- properties of good hash function,types of hash function(division, multiplication, extraction, mid - square, folding and universal).

Collision resolution strategies - open addressing and closed addressing(separate chaining). (with and without replacement).

**Self Study:-** Extendable hashing.

**Further Readings:-** Locality sensitive hashing.

## TEXT BOOKS


1. E. Horowitz S. Sahani, D. Mehta.(2018).*Fundamentals of Data Structures in C++, 10th Edition, Universities Press. ISBN-13:978-8173716065* .
2. T. Cormen, C Leiserson, R. Rivest, C Stein.(2016) *Introduction to Algorithms, 7th Edition, MIT press. ISBN-13:978-0262533058.* .
3. Michael T. Goodrich, Roberto Tamassia, David M. Mount.(2018).*Data Structures and Algorithms in C++, 5th Edition, John Wiley Sons. ISBN-13: 978-0470383278* .


## REFERENCE BOOKS


1. Seymour Lipschutz.(2014).*Data Structures with C, Revised First Edition, Schaum's Outline Series. ISBN 13: 978-1259029967*
2. Richard F. Gilberg, Behrouz A Forouzan. (2016).*Data structures- A Pseudocode Approach with C++, 4th Edition , Cengage l earning. ISBN-13: 9780534390808.* .
3. E.Horowitzs S. Sahani, S. Rajashekharan. (2015).*Fundametals of Computer Algorithms, Universities Press. ISBN-13:978-8 173716126*.
4. Debasis Samanta. (2012).*Classic Data Structures, 2nd Edition, TMH. ISBN-13: 978-8120337312*


## E-RESOURCES

1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106106127

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | COMPUTER GRAPHICS |
| | COURSE CODE | 2308213T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** Mathematics, Foundation of Computing.

## COURSE OBJECTIVES :

2308213T.CEO.1: To explain the basic concepts of computer graphics.
2308213T.CEO.2: To make familiar with mathematics behind graphical representation with the multimedia systems.
2308213T.CEO.3: To emphasize on implementation aspect of Computer Graphics Algorithms
2308213T.CEO.4: To get acquainted with different methods of projections and viewing
2308213T.CEO.5: To describe various methods of clipping.
2308213T.CEO.6: To provide the basic knowledge of light, color and texture mapping

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308213T.CO.1: Apply OpenGL graphics primitives to develop graphics applications. [L3].
2308213T.CO.2: Solve the real time problems using geometric transformations. [L3]
2308213T.CO.3: Develop 2D and 3D objects using various algorithms. [L3]
2308213T.CO.4: Apply various methods for projection and viewing it into real world.[L3]
2308213T.CO.5: Implement the suitable clipping algorithms. [L3]
2308213T.CO.6: Design the texture images, light and color using different objects. [L3]

**COURSE ABSTRACT:**

Computer Graphics is one of the fundamental aspects of any computing system. Computer Graphics can be used in UI design, rendering, geometric objects, animation. This course offers exploration of Computer Graphics fundamentals, present day graphics hardware (I/O devices, GPU) and the widely popular openGL graphics library with programming basics, different types of GUI, multimedia archi- tecture, recent technologies in multimedia, Computer Graphics core algorithms for drawing geometric shapes like line, circle, polygon, basic of 2D and 3D transformations, matrices, window and viewport concept, different line and polygon clipping algorithm, various color models with texture mapping. The goal of Computer Graphics study is to impart the knowledge of technology, procedures, and develop skills in computer graphics with multimedia.

**THEORY COURSE CONTENTS**

| UNIT 1 | REAL WORLD INTERACTION | 05 HOURS |
|---|---|---|

**Applications/Case Study:** Games, Animation

**Contents:** OpenGL as a State Machine, Display Points, Lines, and Polygons in OpenGL, OpenGL Geometric Drawing Primitives, Normal Vectors, Vertex Arrays, OpenGL Rendering Pipeline, OpenGL- Related Libraries Basics of GLUT. Animations: Introduction, Animation Languages,Rendering pipeline. .

**Self Study:** Gaming,Introduction to GPU, Gaming platform (NVIDIA CUDA, i8060), Advances in Gaming

**Further Readings:** Simulations,Physics-based and procedural animations.

| UNIT 2 | GRAPHICAL USER INTERFACES AND MULTIMEDIA | 05 HOURS |
|---|---|---|

**Applications/Case Study:** Display devices- OLEDs, Micro LEDs, Radar displays

**Contents:** Introduction, Pixel, Frame buffer, Resolution, Aspect ratio, Raster scan and Random scan display, Primitives: Lines, Line segments, Vector, Vectors Display file Structure, display file Interpreter, Character generating methods, Alising and Antialiasing techniques.

**Self Study:**CRT basics, Flat panel displays, Plasma Panel

**Further Readings:**hypermedia.

| UNIT 3 | SCAN CONVERSION | 05 HOURS |
|---|---|---|

**Applications/Case Study:** Design of different 2D objects and 3D objects

**Contents:** Line Drawing algorithms: DDA, Bresenham, Circle drawing algorithms: Bresenham, Mid-point Filled Area Primitive: Polygon, Types of Polygons, Inside and outside tests, Scan line polygon Fill Algorithm, Boundary Fill and Flood Fill Algorithm

**Self Study:** Line styles: Thin, Thick, Dotted, Self-Intersecting polygon.

**Further Readings:**DDA Circle drawing algorithm, Different Polygon filling algorithms.

| UNIT 4 | 2D AND 3D GEOMETRIC TRANSFORMATION | 05 HOURS |
|---|---|---|

**Applications/Case Study:** Animation, Augmented Reality

**Contents:** 2D Transformations: Introduction, Matrices, Translation, Scaling, Rotation, Homogeneous coordinates and matrix representation, rotation about an origin, rotation about an arbitrary point, Inverse transformation, Shear transformation, Reflection

3D Transformations: Introduction, Matrices, Rotation about an arbitrary axis,s

**Self Study:** Classification of Projection,Parallel and Perspective projection

**Further Readings:**Composite Transformation

| UNIT 5 | WINDOWING,CLIPPING AND CURVES | 05 HOURS |
|---|---|---|

**Applications/Case Study:** Image Segmentation, 2D viewing

**Contents:** Windowing: Introduction, Viewport, viewing transformation, Clipping: 2D clipping,line clipping algorithm,Polygon clipping Algorithms.

Curve: Introduction to curve generation, Interpolation, B-Splines, Bezier curve, Blending function

**Self Study:** Irregular curves: Joints and Knots

**Further Readings:**3D Viewing, 3D Clipping, Cyrus – Beck Clipping, Triadic curve, Fractals.

| UNIT 6 | LIGHT, COLOR MODELS AND TEXTURE MAPPING | 05 HOURS |
|---|---|---|

**Applications/Case Study:** graphical 3-D model effects

**Contents:** Light: Introduction, Diffused illumination, point source illumination

Texture-Mapping: Process, steps of Texture Mapping, Specifying the Texture.

**Self Study:** Shading algorithms

Color models: RGB, HSV, CMY

**Further Readings:** Hidden Surface and back face removal algorithms.

## TEXT BOOKS


1. Steve Marschner,Peter Shirley (2021). *Fundamentals of Computer Graphics*. 7th Edition, CRC press . ISBN 9781032122861.
2. D. Hearn and M. Baker (2002). *Computer Graphics*. 2nd Edition, Pearson Education. ISBN 7808- 7944.
3. D. Rogers (2001). *Procedural Elements for Computer Graphics*. 2nd Edition, Tata McGraw-Hill publication. ISBN 0-07-047371-4.
4. S. Harrington (1987). *Computer Graphics*. 2nd Edition, McGraw-Hill publication. ISBN 0-07-100472-6.
5. D.Rogers, J.Adams(2002). *Mathematical Elements for Computer Graphics*. 2nd Edition, Tata McGraw-Hill publication, ISBN 0-07-048677-8.
6. Foley, van Dam, Feiner, Hughes, and Phillips(1994). *Introduction to Computer Graphics*. 2nd Edition, ISBN 978-0-201-60921-9
7. Yoshinori Dobashi , Shizuo Kaji Kei Iwasaki(2019). *Mathematical Insights into Advanced Computer Graphics Techniques* . 1st Edition,
8. Edward Angel(2012). *Interactive Computer Graphics: A Top-Down Approach Using OpenGL* . 6th Edition,Addison-Wesley .


## REFERENCE BOOKS


1. James D.Foley,Andries Van Dam (2018). *Fundamentals of Interactive Computer Graphics*. 13th Edition, AddisonWesley.
2. M. Woo, J. Neider, T. Davis, D. Shreiner *2. OpenGL Programming Guide: The Official Guide to Learning OpenGL*. 3rd Edition, Addison-Wesley.
3. *OpenGL Reference Manual*. rd , OpenGL Architecture Review Board
4. Steve Marschner, Peter Shirley *Fundamentals of Computer Graphics*. 4th Edition, o'reilly.


## E-RESOURCES

1. https://nptel.ac.in/courses/106102063
2. https://nptel.ac.in/courses/106106090

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | PROGRAMMING LABORATORY |
| | COURSE CODE | 2308214L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE KNOWLEDGE :** Foundation of Computing

## COURSE OBJECTIVES :

2308214L.CEO.1: To explain fundamental data structures and their applications in programming and problem solving.
2308214L.CEO.2: To illustrate abstract data representation methods.
2308214L.CEO.3: To build the ability to synthesize and analyze algorithms.
2308214L.CEO.4: To build the ability to identify appropriate data structure for the specified problem.
2308214L.CEO.5: To demonstrate various techniques of searching and sorting.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308214L.CO.1: Develop applications using arrays. [L3].
2308214L.CO.2: Choose suitable type of linked list for various applications. [L3].
2308214L.CO.3: Build scenario based applications using stack and queue. [L3].
2308214L.CO.4: Solve given problems using searching and sorting techniques. [L3].
2308214L.CO.5: Apply suitable hashing techniques for solving given problems. [L3].

**COURSE ABSTRACT:**

The basic aim of the course is to make students understand concept of implementing abstract data representation for organizing and managing the data efficiently. Implementation of primitive data structures, various operations and related algorithms, applicability of data structures in real time applications are all covered in the syllabus.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **ARRAYS** | **4 HOURS** |

Design and implement a program to read, display, insert, update and delete operations on data objects using array for any one of the following application:-

1. Customer Management System
2. Aadhar Card Management System
3. Library Management System

**Self-Study:-** Practice Problem No 1

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **2D ARRAYS** | **4 HOURS** |

Implement a program for storing a sparse matrix using 2-D Array for following operations:-

1. Compute transpose of matrix
2. Compute fast transpose of matrix
3. Add and multiply two sparse matrices

**Self-Study:-** Practice Problem No 2

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **LINKED LIST** | **8 HOURS** |

Design and develop program for insertion, updating, searching, sorting, listing and deletion operations using singly linked list for any one of the following applications :-

1. Placement Information System
2. Railway Reservation System
3. Billing System at Mall

**Self-Study:-** Practice Problem No 3

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **DOUBLY LINKED LIST** | **4 HOURS** |

Design and implement a program for sorting two given lists and merging these two sorted lists of marks scored for technical skill examination of recruitment cell using doubly linked list.

**Self-Study:-** Practice Problem No 4

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **CIRCULAR LINKED LIST** | **4 HOURS** |

Pizza parlor accepting maximum M orders. Orders are served in first come first served basis. Order once placed cannot be cancelled. Write a program to simulate the system using circular linked list.

**Self-Study:-** Practice Problem No 5

| PRACTICAL NO.06 | STACK | 4 HOURS |
|---|---|---|

Given as input a prefix expression. Implement a program for following conversions :-

a) prefix to infix

b) Infix to postfix,

c) postfix evaluation

**Self-Study:-** Practice Problem No 6

| PRACTICAL NO.07 | RECURSION | 2 HOURS |
|---|---|---|

Design and implement a program for 2 * 2 Suduko Solver using Recursive Backtracking

**Self-Study:-** Practice Problem No 7

| PRACTICAL NO.08 | CIRCULAR QUEUE | 6 HOURS |
|---|---|---|

Implement Round Robin CPU Scheduling using circular queue for the following :-

| Process | P1 | P2 | P3 | P4 | P5 |
|---|---|---|---|---|---|
| Arrival Time | 0 | 1 | 2 | 3 | 4 |
| Burst Time | 5 | 3 | 1 | 2 | 3 |

**Self-Study:-** Practice Problem No 8 and 9

| PRACTICAL NO.09 | DOUBLY ENDED QUEUE | 6 HOURS |
|---|---|---|

Design and implement a program for double ended queue and its operations for a shopping mall under given Scenarios :-

a) Input Restricted Deque

b) Output Restricted Deque.

**Self-Study:-** Practice Problem No 10

| PRACTICAL NO.10 | SEARCHING AND SORTING | 12 HOUR |
|---|---|---|

Consider a student database of TY BTECH class (at least 15 records). Database contains different fields of every student like Roll No, Name, SGPA and Department. Perform the following operations:-

a) Design a roll call list, arrange list of students according to roll numbers in ascending order (Use Bubble Sort).

b) Arrange list of students alphabetically. (Use Insertion sort).

c) Arrange list of students to find out first ten toppers from a class. (Use Quick sort).

d) Search students according to SGPA. If more than one student having same SGPA, then print list of all students having same SGPA. (Use Linear Search).

e) Search a particular student according to name using binary search without recursion. (all the student records having the presence of search key should be displayed) (Use Binary Search).

f) Search whether a particular student belongs to computer department or not.(Use Fiibonacci Search).

**Self-Study:-** Practice Problem No 11 and 12

| PRACTICAL NO.11 | HASHING | 6 HOURS |
|---|---|---|

a) Raman has a cold drink corner shop in he wants to store information about different flavours of cold drink available in a table using hash function hash (key) = key mod 6 where key is the data to be inserted into the Hash table. Write a C++ program to implement hash table for collision handling using linear probing without chaining without replacement.

b) Marks out of 100 of 20 students needs to be stored in a table using hash function hash (key) = key mod 20 where key is the data to be inserted into the Hash table. Write a C++ program to implement hash table for collision handling using separate chaining without replacement using linked list for the following data :- 33,56,78,12,10,67,89,99,100,23,45,71,39,62,59,90,91,20,75,66.

c) Lalit has a fresh mango fruit shop and he wants to store information about 11 varieties of mangoes available in a table using hash function hash (key) = key mod 11 where key is the number of mangoes of each category . write a C++ program to implement hash table for collision handling using quadratic probing without replacement for the following data.

| Category | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No of Mangoes | 25 | 15 | 10 | 5 | 11 | 19 | 16 | 36 | 42 | 28 | 32 |

**Self-Study:-** Practice Problem No 13 and 14

**PRACTICE PROBLEMS:**

1. Implement a program for left rotation and right rotation of array by a given number k.
2. Implement a program for addition and multiplication of two matrices using concepts of 2-D arrays.
3. Implement a program for addition of two polynomials using concepts of linked list.
4. Implement a program for merging a doubly linked list into another doubly linked list at alternate positions and sorting the resultant doubly linked list.
5. Implement railway reservation system using a circular linked list.
6. Implement 8 Queens problem using stack.
7. Implement Tower of Hanoi problem using concept of recursion.
8. Implement basic operations of priority queue for managing the appointments of patients at a hospital.
9. Implement FCFS and SJF scheduling in non-preemptive mode using suitable queue.
10. Implement a program to check whether the given string is palindrome or not using doubly ended queue.
11. Implement a program to store names and mobile numbers of your friends in sorted order on names. Search your friend from list using Sentinel search. Insert friend if not present in phone book.
12. Implement a program to store percentage of second year students in array. Write a function for sorting array of floating point numbers in ascending order using Merge Sort.
13. Scores of batsman in twelve overs needs to be stored in a table using hash function hash (key) = key mod overs where key is the data to be inserted into the Hash table. Write a C++ program to implement hash table for collision handling using separate chaining with replacement using linked list for the following data :- 10, 5,4,14,15,20,1,11,6,16,36,28.
14. Vinay has a medical shop and he wants to store information of medical stock available in a table using hash function hash (key) = key mod 9 where key is the data to be inserted into the Hash table. Write a C++ program to implement hash table for collision handling using linear probing without changing with replacement.

## TEXT BOOKS


1. E. Horowitz S. Sahani, D. Mehta. (2018). *Fundamentals of Data Structures in C++" , 10th Edition, Universities Press. ISBN-13: 978-8173716065.*
2. Michael T. Goodrich, Roberto Tamassia, David M. Mount. (2018). *Data Structures and Algorithms in C++*, 5th Edition, John Wiley Sons. ISBN-13: 978-0470383278
3. T. Cormen, C Leiserson, R. Rivest, C Stein. (2016) *Introduction to Algorithms.7th Edition MIT press,2016,ISBN-13: 978-0262533058*.


## REFERENCE BOOKS


1. Richard F. Gilberg, Behrouz A Forouzan. (2016). *Data structures- A pseudocode Approach with C++" 4th Edition, Cengage l earning. ISBN 9780534390808.*.
2. E. Horowitzs S. Sahani, S. Rajashekharan. (2015). *Fundametals of Computer Algorithms, Universities Press. ISBN-13: 978-8 173716126*
3. Debasis Samanta.(2012). *Classic Data Structures, 2nd Edition, Tata McGraw Hill. ISBN-13: 978-8120337312*.


## E-RESOURCES

1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106106127

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F. | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Problem Solving Using Object Oriented Programming (C++) |
| | COURSE CODE | 2308261L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE : BASIC COMPUTING KNOWLEDGE**

**COURSE OBJECTIVES :**

2308261L.CEO.1: To demonstrate Object Oriented Programming concepts.
2308261L.CEO.2: To illustrate modularity, scalability and code reusability.
2308261L.CEO.3: To identify various perspectives of a problem.
2308261L.CEO.4: To choose the optimal solution for real life problems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2308261L.CO.1: Develop solutions for real world problems using Object Oriented Programming. [L3]
2308261L.CO.2: Choose an appropriate programming solution to reduce complexity. [L3]
2308261L.CO.3: Apply critical thinking and programming skills for problem solving. [L3]
2308261L.CO.4: Utilize logic building traits efficiently for solving real life problems. [L3]

## COURSE ABSTRACT:

Problem Solving using Object Oriented Programming (C++) is the Skill Development Course. The basic aim of the course is to introduce the students to Object Oriented Programming using C++ and make their concepts clear for designing real time applications using the same. The inclusion of Challenging Problems in the course will enhance students' logical thinking and boost their analytical skills. Various stages in problem solving will help students to deal with complex problems easily. This course will improve students problem solving abilities and coding skills.

## CONTENTS :

Introduction to C++, Tokens, Data types, Operators, Structure of C++ Programs, Classes and Objects, Constructors, Destructors; Arrays, Expressions and Control Structures, Types of Constructors and Member Functions; Overloading; Reference and Pointers, Dynamic Memory Management; Functions in C++: Argument passing in function, Inline Functions, Default Arguments, Constant Argu- ments, Friend class, Friend function; Inheritance; Polymorphism; Exception Handling; std::move in utility; Templates; Standard Template Library; Type casting and cast operators.

**Self Study:** Structures, Union

**Further Readings:** File Handling Operations, Multithreading

| **OBJECT ORIENTED PROGRAMMING:** | | |
|---|---|---|
| **PRACTICAL: All assignments should be performed considering real world applications.** | | |
| **PRACTICAL NO.01** | **CLASS AND OBJECTS** | **2 HOURS** |
| Write a program on class, constructor, destructor, and user-defined functions. | | |
| **PRACTICAL NO.02** | **CONSTRUCTOR TYPES** | **2 HOURS** |
| Implement various types of constructors and member functions. | | |
| **PRACTICAL NO.03** | **OPERATOR OVERLOADING** | **2 HOURS** |
| Write a program on operator overloading using default and parameterized constructors. | | |
| **PRACTICAL NO.04** | **DYNAMIC MEMORY** | **4 HOURS** |
| a) Assignment based on references and pointers.<br>b) Write a program on new and delete operators in C++ for dynamic memory. | | |
| **PRACTICAL NO.05** | **FUNCTION TYPES, FRIEND CLASS** | **4 HOURS** |
| Assignment based on class, objects, this pointer, inline function, static member function and friend class. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.06** | **INHERITANCE** | **2 HOURS** |
| Implement different types of inheritance. | | |
| **PRACTICAL NO.07** | **POLYMORPHISM** | **2 HOURS** |
| Write a program on polymorphism. | | |
| **PRACTICAL NO.08** | **EXCEPTION HANDLING** | **2 HOURS** |
| Implement exception handling operations. | | |
| **PRACTICAL NO.09** | **STD::MOVE IN UTILITY** | **2 HOURS** |
| Write a program on std::move in utility. | | |
| **PRACTICAL NO.10** | **TEMPLATES** | **2 HOURS** |
| Implement class template, function template. | | |
| **PRACTICAL NO.11** | **STANDARD TEMPLATE LIBRARY** | **4 HOURS** |
| a) Assignment based on list class as a container of standard template library.<br>b) Assignment based on vector class as a container of standard template library. | | |
| **PRACTICAL NO.12** | **TYPE CASTING** | **2 HOURS** |
| Assignment based on type casting and casting operators. | | |

| PROBLEM SOLVING: | | |
|---|---|---|
| 01 | BASIC PROGRAMMING | 2 HOURS |
| 02 | NUMBER SYSTEM | 2 HOURS |
| 03 | ARRAY | 2 HOURS |
| 04 | MATRIX | 2 HOURS |
| 05 | STRING | 2 HOURS |
| 06 | MATH | 2 HOURS |
| 07 | BIT MANIPULATION | 2 HOURS |
| 08 | SEARCHING AND SORTING | 2 HOURS |
| 09 | INHERITANCE | 2 HOURS |
| 10 | POLYMORPHISM | 2 HOURS |
| 11 | TEMPLATES/COLLECTION | 2 HOURS |
| 12 | MULTITHREADING | 4 HOURS |
| 13 | STACK AND QUEUE (FURTHER PRACTICE) | 2 HOURS |
| 14 | FILE PROCESSING (FURTHER PRACTICE) | 2 HOURS |

## EXAMINATION SCHEME

1. Continuous Assessment: 20 Marks
2. Mid Semester Practical Examination for Problem Solving: 15 Marks
3. End Semester Practical Examination for OOP(C++): 20 Marks
4. End Semester Practical Examination for Problem Solving: 20 Marks

## TEXT BOOKS


1. E. Balgurusawmy. (2020). *Object Oriented Programming with C++*. 8th Edition, McGraw Hill Publishers. ISBN 9389949181.
2. Paul Deitel, Harvey Deitel. (2017). *C++: How to Program*. 10th Edition, Pearson International. ISBN 9789332585737.
3. Sprankle Maureen. (2011). *Problem Solving and Programming Concepts*. 9th Edition, Person. ISBN 978-0132492645.
4. Savitch Walter. (2017). *Problem Solving with C++*. 10th Edition, Person. ISBN 978-0134448282.

## REFERENCE BOOKS


1. Bjarne Stroustroup. (2014). *Programming - Principles and Practice using C++*. 2nd Edition, Addison-Wesley Educational Publishers Inc . ISBN 978-0275967819.
2. Herbtz Schildt. (2017). *C++: The Complete reference*. 4th Edition, McGraw Hill Education. ISBN 978-0070532465.
3. V. Anton Spraul. (2012). *Think Like a Programmer: An Introduction to Creative Problem Solving*. 1st Edition, No Starch Press US. ISBN 978-1593274245.


## E-RESOURCES

1. https://nptel.ac.in/courses/106105151
2. https://nptel.ac.in/courses/106101208

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Problem Solving Using Object Oriented Programming (JAVA) |
| | COURSE CODE | 2308262L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** FUNDAMENTALS OF COMPUTING

## COURSE OBJECTIVES :

2308262L.CEO.1: To demonstrate Object Oriented Programming concepts.
2308262L.CEO.2: To illustrate modularity, scalability and code reusability.
2308262L.CEO.3: To identify various perspectives of a problem.
2308262L.CEO.4: To choose the optimal solution for real life problems.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308262L.CO.1: Develop solutions for real-world problems using Object Oriented Programming. [L3]
2308262L.CO.2: Choose an appropriate programming solution to reduce complexity. [L5]
2308262L.CO.3: Apply critical thinking and programming skills for problem solving. [L3]
2308262L.CO.4: Utilize logic building traits efficiently for solving real life problems. [L3]

**COURSE ABSTRACT:**

Problem Solving using Object Oriented Programming (JAVA) is the Skill Development Course. The basic aim of the course is to introduce the students to Object Oriented Programming using JAVA. and make their concepts clear for designing real time applications using the same. The inclusion of Challenging Problems in the course will enhance students' logical thinking and boost their analytical skills. Various stages in problem solving will help students to deal with complex problems easily. This course will improve students problem solving abilities and coding skills.

**CONTENTS :**

Basics of Java, Data Types and Variables, Operators, Control Statements,Looping, Arrays; String, String Buffer, String Builder; Methods, Lambda Expression, Constructor; Object Oriented Program- ming System : Classes and Objects, Modifiers, Inner Classes; Inheritance; Super,This,Static and Final Keywords; Polymorphism: Method Overloading, Method Overriding; Abstraction, Interfaces; Excep- tion Handling, Create Own Exceptions; Multithreading ; Packages, Collections Framework; File Han- dling; Generics; Introduction to Swing: Layout Management , Swing Components ,Text Fields , Text Areas ,Buttons, Check Boxes, Radio Buttons , Lists, Choices, Scrollbars , Windows ,Menus , Dialog Boxes;

**Self Study:** Bytecode in Java ,Bytecode vs Machine code, JRE, Java API,JVM in Java,JVM Architecture, Class Loader,Interpreter in Java Interpreter vs Compiler,Download Install Java Development Kit JDK,Download Eclipse IDE for Java Developers

| **OBJECT ORIENTED PROGRAMMING USING JAVA:** | | |
|---|---|---|
| **PRACTICAL: All assignments should be performed considering real world applications.** | | |
| **PRACTICAL NO.01** | **FUNDAMENTALS OF JAVA** | **4 HOURS** |
| a) Write a program based on the basics of Java<br>b) Implement a program using Control Statement, Looping, Array | | |
| **PRACTICAL NO.02** | **STRING, STRING BUFFER, STRING BUILDER** | **2 HOURS** |
| a) Program for implementing string operations | | |
| **PRACTICAL NO.03** | **CLASS-OBJECT, METHODS, CONSTRUCTORS AND LAMBDA EXPRESSION** | **4 HOURS** |
| a) Write a program to create Class, declare Member Variables, Define Methods<br>b) Program to define Constructor, Passing Information to a Method or a Constructor.<br>c) Program to define lambda expression | | |
| **PRACTICAL NO.04** | **JAVA INHERITANCE** | **2 HOURS** |
| a) Program to implement all types of Inheritance | | |

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **STATIC, FINAL , SUPER AND THIS KEYWORD** | **2 HOURS** |
| a) Program to implement static, final , super and this keyword in java | | |
| **PRACTICAL NO.06** | **POLYMORPHISM** | **2 HOURS** |
| a) Program to implement polymorphism | | |
| **PRACTICAL NO.07** | **JAVA ABSTRACT CLASS AND INTERFACES** | **2 HOURS** |
| a) Write a program based on Abstract Class<br>b) Write a program based on Interfaces | | |
| **PRACTICAL NO.08** | **EXCEPTION HANDLING** | **2 HOURS** |
| a) Implement a program to handle different exceptions<br>b) Implement a program to create own exception class | | |
| **PRACTICAL NO.09** | **JAVA SWING** | **4 HOURS** |
| a) Write a program for multi threading<br>b) Write a program to create Frame and make use of Layout Management, User Interface Components | | |
| **PRACTICAL NO.10** | **PACKAGES AND COLLECTIONS** | **2 HOURS** |
| a) Implement a program to create own package<br>b) Implement a program based on Java collections | | |
| **PRACTICAL NO.11** | **FILE HANDLING** | **2 HOURS** |
| a) Write a program for file handling operations | | |
| **PRACTICAL NO.12** | **JAVA GENERICS** | **2 HOURS** |
| a) Implement various generic functions and generic class | | |

| PROBLEM SOLVING USING JAVA: | | |
|---|---|---|
| 01 | BASIC PROGRAMMING | 2 HOURS |
| 02 | NUMBER SYSTEM | 2 HOURS |
| 03 | ARRAY | 2 HOURS |
| 04 | MATRIX | 2 HOURS |
| 05 | STRING | 2 HOURS |
| 06 | MATH | 2 HOURS |
| 07 | BIT MANIPULATION | 2 HOURS |
| 08 | SEARCHING AND SORTING | 2 HOURS |
| 09 | INHERITANCE | 2 HOURS |
| 10 | POLYMORPHISM | 2 HOURS |
| 11 | COLLECTION | 2 HOURS |
| 12 | MULTITHREADING | 4 HOURS |
| 13 | STACK AND QUEUE (FURTHER PRACTICE) | 2 HOURS |
| 14 | FILE PROCESSING (FURTHER PRACTICE) | 2 HOURS |

## EXAMINATION SCHEME

1. Continuous Assessment: 20 Marks
2. Mid Semester Practical Examination for Problem Solving: 15 Marks
3. End Semester Practical Examination for OOP(Java): 20 Marks
4. End Semester Practical Examination for Problem Solving: 20 Marks

## TEXT BOOKS


1. Herbert Schildt.(2021). “Java The complete reference”, 12th Edition, McGraw Hill Education.
2. Cay S. Horstmann, Gary cornell.(2021). “Core Java Volume –I Fundamentals”, 12th Edition, Prentice Hall.


## REFERENCE BOOKS


1. K. Arnold and J. Gosling. (2005).“The JAVA programming language”, Fourth edition, Pearson Education.
2. Timothy Budd. (2000). “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education.
3. C. Thomas Wu. (2006). “An introduction to Object-oriented programming with Java”, Fourth Edition, Tata McGraw-Hill Publishing company Ltd.


## E-RESOURCES

1. https://nptel.ac.in/courses/106105191

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | ENVIRONMENTAL SCIENCE |
| | COURSE CODE | 2301286 |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2301286.CEO.1: To study a fundamental and ecological concept of environment.

2301286.CEO.2: To enable students to have a nuanced understanding of environmental pollution, solid waste management and climate change and to act with concern on environmental issues.

2301286.CEO.3: To develop a sense of responsibility towards society and the environment.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2301286.CO.1: Demonstrate the importance of ecosystem and biodiversity for maintaining ecological balance [L3].

2301286.CO.2: Identify different types of environmental problems and their control measures [L3].

2301286.CO.3: Apply environmental legislation and sustainable development concept [L3].

**COURSE ABSTRACT:**

This course provides an overview of the significance of ecosystems, including environmental pollution, biodiversity and its conservation, and environmental law. Discussions of environmental issues begin with climate change, global warming, and other environmental challenges. A model for the generation of Power as Solar, Wind, and Water is required for students as part of the Green Energy Corridor Project creative exercise. Students will do a brief project on any environmental idea to help them build a positive attitude towards the environment, such as the reuse, recycle, and reduce principle, environ- mental pollution monitoring and control, the material balance principle, sustainable development, or environmental innovations.

**THEORY**

| UNIT 1 | Overview of Environment: Field Study (Minimum 2) | 06 HOURS |
|---|---|---|

**Theory Content**: Concept of Ecology and Environmental Science, Biogeochemical cycle, Ecosystem and its management. Fate of Environmental Pollutant, Environmental status, Effect on climate change.

**Student will present in the following stages for the activities.**

- Stage I Inception (2 Hours)
- Stage II Data Collection (2 Hours)
- Stage III Analysis (2 Hours)

**Activity No: 1 (Group activity includes, only 5 members, Geo-tag photos, Detailed site visit report)**

Students have to visit any one nonhazardous polluted site for finding the various reasons of its pollution and suggest preventive measures for it.

Non Hazardous Site includes any of the following place:

- River
- Solid Waste Treatment Plant
- Garbage collection points
- Industries
- Site which comes under either of Soil, Water, Air or Industrial pollution

Visit report must content Geotag Photos and detailed site visit record. Visit can be done in a group up to 4 members only.

**Activity No: 2 (Individual activity)**

To describe the climate of an urban area by analyzing hourly variation of NCAP(National Clean Air Program) acclaimed Pollutant in the same area.

**Activity No: 3(Group activity)**

Environmental awareness programs under Swatch Bharat Mission like, Sachet Hi Sews, Swachhta pakhwada, Special Drive before Diwali, organizing essay competition, poster competition, slogan mak- ing competition, Awareness about minimum electricity consumption in campus, Celebrating various Environmental Days.

| UNIT 2 | Environmental Pollution (Minimum 3) | 08 HOURS |
|---|---|---|

**Theory Content**: Environmental Pollution: Air, Water, Soil, Solid and Hazardous Waste Management; Environment and human health, Over utilization of natural resources, Environmental Legislation, Environmental monitoring organizations in India, Environmental Protection Agency (EPA).

**Activities:**

1) Activity No. 1 Determination of PH and Electrical Conductivity of Water Sample.
2) Activity No. 2 Segregation of waste from source. (Visit to garbage segregation disposal site)
3) Activity No. 3 Measurement of noise using sound level meter.
4) Activity No. 4 Study of soil property, Temperature, Texture and Particle Size.

| UNIT 3 | Creative Exercise : Global Environmental Issues (Any One) | 08 HOURS |
|---|---|---|

**Theory Content**: Introduction to climate change, Global warming, Acid rain, Ozone layer depletion, Plastic waste management, Municipal solid waste management, Food problem, E-waste management, Social Issues: Environmental ethics and economics. (This content is for reference during practical)

**Creative Activities:**

1) The Green Energy Corridor Project Develop lab working model alternatives to renewable energy sources like solar, wind, and water for the production of power.
2) Use of social media platform for E networking and Dissemination of ideas on Environmental Issues.
3) Study of 8 National Missions on climate change as per National Action Plan on Climate Change (NAPCC), GOI.
4) Make a report on UN Goals on sustainability and also different effective measures were taken for the Conservation of Rivers in India.

| UNIT 4 | Project Work (Compulsory) | 08 HOURS |
|---|---|---|

**Project work Description:**

Students have to identify the real life environmental problems from their daily observations and try to find out the various feasible solutions for it as their project work. They are supposed to prepare the prototype, demonstration model, detailed report and present it to the evaluators. The project topic should be related to the below mentioned heads:

1) Reduce, Reuse, Recycle.
2) Environmental Pollution Monitoring and Control Material Balance Concept.
3) Sustainable Development.
4) Environmental Innovations.

The evaluation is based on at least one number of project presentation reviews apart from the final project presentation.

Participation and Certification of Student groups into Any International/National/State/Regional Level competition organized by any Government/Private Agency, NGO's, Consultancy related to Environmental Concerns.

**Rubrics for evaluation of 40 marks, of project-based learning.**

| Month Of Assessment | Assessment task | Marks |
|---|---|---|
| 1 st month | Group of 4 Members Defining objectives methodologies literature review | 10 marks |
| 2 nd month | Model development Poster making | 10 marks |
| 3 rd month | Report preparation and Plagiarism | 10 marks |
| 4 th month | Final presentation | 10 marks |

## TEXT BOOKS


1. Rao, C. S. (2007). Environmental pollution control engineering. New Age International.
2. UNIVER ITy, R. M. B. Tech.(Full Time) Food Process Engineering Curriculum yllabus.
3. Sharma, T., Litoria, P. K., Bajwa, B. S., Kaur, I. (2021). Appraisal of groundwater quality and associated risks in Mansa district (Punjab, India). Environmental Monitoring and Assessment, 193, 1-21.
4. Unit, V. Population explosion in India, China–the present and future scenario. 9 Hours Total: 45 Hours Textbooks 1. TG Jr. Miller, Environmental Science, Wadsworth Publishing Co., 2004. B. TECH. INFORMATION TECHNOLOGY (Minimum Credits to be earned: 193) First Semester Code No.
5. Metcalf, L., Eddy, H. P., Tchobanoglous, G. (1991). Wastewater engineering: treatment, disposal, and reuse (Vol. 4). New York: McGraw-Hill.


## REFERENCE BOOKS


1. Coronel, C., and Morris, S. (2016). Database systems: design, implementation, and management. Cengage Learning.
2. Rotabi, K. S. (2005). Theory bridging between sociology, social work and ecology. Dynamic interchanges and cross-fertilizations: The intellectual legacy of the Odum family. The University of North Carolina at Chapel Hill.
3. Peavy, H. S., Rowe, D. R., Tchobanoglous, G. (1985). Environmental engineering (Vol. 2985). New York: McGraw-Hill.
4. Nagar, S. R. M., District, K. K. Bachelor of Technology (B. Tech.) in Civil Engineering.
5. Henry, J. G., Heinke, G. W., Burton, I. (1996). Environmental science and engineering (Vol. 445, No. 452, pp. 456-457). Upper Saddle River, NJ: Prentice Hall.
6. Mayer, R. H. (2000, June). A Compendium on Environmental Engineering for Ocean Engineering Majors. In 2000 Annual Conference (pp. 5-16).

**E-RESOURCES LINKS**

1. SCIENCE DIRECT- https://www.sciencedirect.com/referencework/9780124095489/earth-systems-and-environmental-sciences
2. UNISCO- https://www.unesco.org/en/climate-changE
3. UN GOALS- https://sdgs.un.org/goals
4. NPTEL COURSE -https://archive.nptel.ac.in/courses/127/105/127105018/

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCE | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | UNIVERSAL HUMAN VALUES-II |
| | COURSE CODE | 2301287 |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | 4 | NIL | NIL | 25 | NIL | 75 | 100 |

## COURSE OBJECTIVES :

2301287.CEO.1: To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

2301287.CEO.2: To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

2301287.CEO.3: To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

2301287.CEO.4: To enhance students confidence by strengthening their Professional Skills and Leadership quality. Thus, this course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

2301287.CEO.5: To develop essential soft skills such as leadership, creative writing, and effective communication through practical activities that encourage collaboration and selfawareness.

2301287.CEO.6: To enhance critical thinking and ethical decision-making skills via scenario-based role plays and group discussions, preparing students for real-world challenges.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301287.CO.1: Evaluate the significance of value inputs in formal education and start applying them in their life and profession [L4].

2301287.CO.2: Analyze the value of harmonious relationship based on trust and respect in their life and profession [L3].

2301287.CO.3: Examine the role of a human being in ensuring harmony in society and nature [L3].

2301287.CO.4: Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession [L4].

2301287.CO.5: Demonstrate improved leadership and communication skills by effectively collaborating and articulating ideas in team settings [L3].

2301287.CO.6: Apply critical thinking and ethical considerations in decision-making, showcasing enhanced time management and problem-solving abilities [L4].

## COURSE ABSTRACT

Every human being has two sets of questions to answer for his/her life: a) what to do? and b) how to do? The first set pertains to the value domain, and the other to the skill domain. Both are complimentary, but value domain has a higher priority. Today, education has become more and more skill biased, and hence, the basic aspiration of a human being, that is to live with happiness and prosperity, gets defeated, in spite of abundant technological progress. This course helps students develop the right understanding and feelings for ethical living. It covers self-exploration, distinguishing between self and Body, building healthy relationships, understanding societal goals, and promoting mutual fulfilment with nature. These insights prepare students to lead ethical lives and professions. Basically, lab is a class that puts together theory and practice on some important soft skills in a dynamic environment. Students shall develop leadership, critical thinking, time management, presentation skills, decisionmaking, emotional intelligence, among others, through very interactive sessions and exercises. This lab will help students succeed in their profession with ethical conduct and collaboration.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction-Basic Human Aspiration, its fulfillment through All-encompassing Resolution** | **3 HOURS** |

**Contents:** The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.

**Self Study:** Exploration of self aspirations and their fulfillment.

| UNIT 2 | Right Understanding (Knowing) - Knower, Known & the Process | 3 HOURS |
|---|---|---|
| **Contents:** The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence its inter-connectedness and co-existence; and finally understanding the role of human being in existence (human conduct).<br>**Self Study:** SWOC Analysis. | | |
| **UNIT 3** | **Understanding Human Being** | **3 HOURS** |
| **Contents:** Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self<br>**Self Study:**Exploration of the relationship between self and other. | | |
| **UNIT 4** | **Understanding Nature and Existence** | **3 HOURS** |
| **Contents:** A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self- awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Partic-ipation of Human in this harmony/ order leading to comprehensive knowledge about the existence).<br>**Self Study:** Exploration of the relationship between self and Nature. | | |
| **UNIT 5** | **Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living** | **3 HOURS** |
| **Contents:** Understanding Human Conduct, different aspects of All-encompassing Resolution (un-derstanding, wisdom, science etc.), Holistic way of living for Human Being with All- encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence.<br>**Self Study:** Exploration of the relationship between self and Universe. | | |

| **PRACTICALS**: PART A (30 Marks) | | |
|---|---|---|
| **PRACTICAL NO.01** | **Skill development: Leadership Skills** | **4 HOURS** |
| Activities: Group Discussion- 1. Self and Resolution 2. Values and Skills. | | |
| **PRACTICAL NO.02** | **Skill development: Creative Writing Skill** | **4 HOURS** |
| Activities: SWOC analysis, Creative Writing: Assignment (Blog, Essay, Articles etc.). | | |
| **PRACTICAL NO.03** | **Skill development: Time Management** | **4 HOURS** |
| Activities: Debate, Social Project with time management. | | |
| **PRACTICAL NO.04** | **Skill development: Presentation Skills** | **4 HOURS** |
| Activities: Presentation, Picture Description. | | |

| PRACTICAL NO.05 | Skill development: Decision Making, Interpersonal Communication, Emotional intelligence | 4 HOURS |
|---|---|---|
| Activities: Scenario based Decision Making, Role Play- Voice Modulation. | | |
| **PRACTICALS**: PART B (20 Marks) | | |
| **PRACTICAL NO.06** | **Verbal, Reasoning and Aptitude Training** | **24 HOURS** |
| 1. Articles, Tenses, Close Passages<br>2. Vocabulary Test, Verb Agreement, Active/Passive Voice<br>3. Antonyms, Synonyms, Preposition<br>4. Idioms and Phrases, Jumbled Sentences, Reading Comprehension<br>5. Sentence Completion, Sentence Correction, Spotting Error<br>6. Confusing Words, One Word Substitution, Fill in the blanks<br>7. Parts of Speech, Reported Speech, Change of Speech<br>8. Number System<br>9. HCF & LCM , Surds and Indices<br>10. Percentages and Average<br>11. Time and work<br>12. Time, Speed and Distance<br>13. Probability<br>14. Quadratic Equations | | |
| **PRACTICALS**: PART C (24 Marks) | | |
| **PRACTICAL NO.07** | **Final Assessment with Help of Career Assessment Tests** | **15 HOURS** |
| Employability and Aptitude assessment tool. | | |

## TEXT BOOKS


1. Gaur, R. R., Sangal, R., & Bagaria, G. P. (2010). A Foundation Course in Human Values and Professionals Ethics. Excel Books India.
2. Premvir Kapoor (2022), Professional Ethics and Human Values, Khanna Book Publishing, New Delhi.
3. Tracy, B. (2008). Speak to Win: how to present with power in any situation. Amacom.

## REFERENCE BOOKS/LINKS


1. A N Tripathy, (2003), Human Values, New Age International Publishers.
2. Meadows, D. H., Meadows, D. H., Randers, J., & Behrens III, W. W. (1972). The limits to growth: a report to the club of Rome (1972). Google Scholar, 91, 2.
3. A Nagraj, (1998), Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
4. Monk, S. (2016). Programming Arduino: getting started with sketches. McGraw-Hill Education.
5. P L Dhar, RR Gaur, (1990), Science and Humanism, Commonwealth Publishers.
6. Subhas Palekar, (2000), How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
7. E G Seebauer& Robert L. Berry, (2000), Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
8. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human
9. B P Banerjee, (2005), Foundations of Ethics and Management, Excel Books.
10. B L Bajpai, ()2004), Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
11. https://www.youtube.com/watch?v=hZSARM4VaVs
12. https://www.youtube.com/watch?v=9-T_zwmnZSc

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Entrepreneurship Skills |
| | COURSE CODE | 2301276 |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | 2 | Nil | Nil | 25 | 20 | 30 | 75 |

PREREQUISITE: Nil

## COURSE OBJECTIVES :

2301255.CEO.1: To create awareness regarding entrepreneurship and encourage for selecting entrepreneurship as career option.

2301255.CEO.2: To provide exposure to the philosophies used in startup culture.

2301255.CEO.3: To introduce a basic pathway to become an entrepreneur.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301255.CO.1: Prepare a venture concept by identifying a problem /opportunity through survey [L3].

2301255.CO.2: Devise a value preposition canvas [L4].

2301255.CO.3: Propose a minimum viable product [L5].

2301255.CO.4: Demonstrate the balance sheet estimation for venture [L3].

| COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **Building Entrepreneurial mindset** | **6 HOURS** |
| Skills required for entrepreneurs, Common misconceptions about entrepreneurship, Dealing with Ambiguity, team formation.<br>**Self study**: Technology readiness levels systems. | | |
| **UNIT 2** | **Problem Identification and Opportunity Discovery** | **8 HOURS** |
| Analysis of different aspects of the venture concept, Revisiting the Problem Statement, Calibrate the Problem Statement on the 'Great Problem Litmus Test', composing the Problem Pitch.<br>**Case Study**: Desi Hangover-the shoe story.<br>**Assessment Activity**: Milestone 1 - Create a Value Proposition Canvas tat describes the venture concept and addresses a specific problem/ opportunity [CO1]. | | |
| **UNIT 3** | **Customer and Markets** | **7 HOURS** |
| Market Identification, Customer segmentation, Carving a Niche for identified opportunity, Market sizing, creating a Customer Persona.<br>**Case Study:** Verloop's story on customer acquisition and growth marketing strategies.<br>**Home assignments:**<br>1. Craft your value proposition .<br>2. Create a Value Proposition Canvas.<br>3. Create a sustainable differentiation strategy. | | |
| **UNIT 4** | **Competitive Advantage** | **6 HOURS** |
| Concept of competition, collecting information about the competition, running a competitive analysis, categories of competition, contribution of the competition in the company's success.<br>**Case Study:** How Inzpira personalized communicative English training with a competitive advantage approach.<br>**Assessment Activity**: Milestone 2 - Build the Lean canvas and create MVP version/s Proposing a minimum viable product[CO2, CO3]. | | |
| **UNIT 5** | **Business model and MVP** | **6 HOURS** |
| Business model and the existing types, selection of business model suitable for the venture, Building the Lean canvas, Creating a Minimum Viable Product, Test the MLP.<br>**Case Study:** The Story of Knorish- How did India's Leading Course Creator Platform Build Its MVP.<br>**Home assignments:** Build the Lean canvas and create MVP version/s.<br>**Assessment Activity**: Milestone 3 - Presentation on financial planning and forecasting that estimates the balance sheet of the venture [CO4]. | | |

| UNIT 6 | Financial Feasibility and building brand in the market | 6 HOURS |
|---|---|---|

Financial planning, Components of a financial plan, Building financial plan and projections, Building the Go-To-Market strategy, Building and Positioning the brand, digital marketing plan.

**Case Study:**

1. How Bodh Gems and Crystals managed and tracked their costs to transform their passion into a profit-making business.
2. How Data Sutram piggybacked on the right channels to scale their business Next Generation Entrepreneur.

**Home assignment:** Presentation on financial planning and forecasting.

| UNIT 7 | Managing growth and funding strategy | 6 HOURS |
|---|---|---|

Devising a Growth Plan, Structure the Scaling Strategy, Devise a Customer acquisition strategy, Mon- itor KPIs and enhance Productivity via Process improvements, Operational Excellence, and Managing Sales Distribution, Identifying funding sources, Mapping Start-Up Cycle to Funding Options, Creating business valuation.

**Case Study:**

1. Torchit's social entrepreneurship brought in a revolution and impacted millions of lives.
2. Growing at 100x with 100X.VC The Art of Fundraising Home assignment: Presentation on growth and funding strategy ur.

**Assessment Activity**: Milestone 4 - Presentation on growth and funding strategy [CO4].

## REFERENCE BOOKS


1. Masters, B., Thiel, P. (2014). *Zero to one: notes on start ups, or how to build the future*. Random House.
2. Ferriss, T. (2017). *Tools of titans: The tactics, routines, and habits of billionaires, icons, and world-class performers.* Houghton Mifflin.
3. Lyons, D. (2016). Disrupted: My misadventure in the start-up bubble. Hachette UK.
4. Robbins, A., *Robbins, T., and Mallouk, P. (2017). Unshakeable: Your Financial Freedom Play-book*. Simon and Schuster.
5. Hansson, D. H., and Fried, J. (2010). *ReWork: Change the Way You Work Forever.* Random House.
6. Financial Management; *Text and Problems, 7th Ed., A Khan and P. K. Jain, Tata MacGraw Hill,* , 44th ISBN: 9789353162184.
7. Kapal, R. (2018). *Kites in a Hurricane: Startups from Cradle to Fame.* Sage Publications Pvt. Limited.
8. Koontz, H., O'Donnell, C., *Weihrich, H. (1986). Essentials of management (Vol. 18).* New York: McGraw-Hill.
9. Prasanna, C. (2001). *Financial Management Theory and Practice. Tata McGraw.* Tata MacGraw Hill.

**E-RESOURCES**

1. Wadhwani Foundation - https://wadhwanifoundation.org/
2. Startup India Learning Program - https://www.startupindia.gov.in/content/sih/en/learning-and-development$_v$2.*html*

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Project Design |
| | COURSE CODE | 2308291L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE:** Knowledge of engineering fundamentals.

## COURSE OBJECTIVES :

2308291.CEO.1: To develop a sense of curiosity and critical thinking approach for designing solutions to the real world problems.

2308291.CEO.2: To disseminate the project planning-scheduling techniques and industry standards.

2308291.CEO.3: To cognize the ethical principles, industry standards in general and its importance in project documenting and ethical writing.

2308291.CEO.4: To encourage to integrate the multiple project design ideas.

2308291.CEO.5: To encourage to work in a team and cooperate the team members.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2308291.CO.1: Design solutions for solving real world problems using critical thinking systematic approach [L3].

2308291.CO.2: Plan the project activities with respect to timeline, skills and resources required considering the project costs estimations [L3].

2308291.CO.3: Apply the knowledge of professional ethics and Industry standards for project design and documentation [L3].

2308291.CO.4: Demonstrate an ability to integrate the multiple project design ideas to develop the designs of product/ processes/ software [L4].

2308291.CO.5: Demonstrate an ability to work in a team and cooperate the team members by showing the responsible behaviour [L5].

## COURSE ABSTRACT

It is a need of the time to pay attention to the societal needs by an engineering graduate to solve some of the real life societal problems by providing affordable technological solutions. The concept of the field project follows the same theme. The project design aims to identify the problems that are faced by the society and develop the systems / processes / products to provide solutions for the same using science and technology for the betterment of society or human life. This may help students to understand the process of product/project development, best practices and encourage their creativity to solve real life problems. The students shall refer scientific literatures from the books, journals of repute. The students shall learn effective team building, designing, budgeting, planning, engineering skills and processes, safety norms and industry standards while developing the application/ products / processes. The students shall learn the importance of technical documentation and professional ethics.

## Guidelines

1. Every student shall undertake the Project in semester III and IV.
2. Every student shall work on an approved project, preferably a field project to work in a group of 03/04 (Max.) students.
3. The group members may be from different programme to support the interdisciplinary / multi-disciplinary functioning.
4. The students have to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
5. Collect the sufficient data and survey to establish the criticality of the problem to be solved.
6. Apply various tools for project planning and design.
7. Critically analyze various design solutions/techniques to solve real world problems.
8. Select and justify one of the solutions identified based on the feasibility, affordability and ease of use.
9. Learn and apply industry standards and professional ethics.
10. Adherence to the highest principles of ethics, conduct and practices.

## TIMELINE

The THREE member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Formation of Project Group and topic exploration: 2 Weeks ($1^{st}$ and $2^{nd}$ week)
2. Finalizing title, survey, feasibility study and approval: 3 Weeks ($3^{rd}$ to $5^{th}$ week)
3. Engineering Ethics: $3^{rd}$ week
4. Project Review 1 Presentation: $6^{th}$ week
5. Analysis and Design of the Project: 3 Weeks ($7^{th}$ to $9^{th}$ week)
6. Project Review 2 Presentation: $10^{th}$ week
7. Report Writing, Documentation and Presentation: 2 Weeks ($11^{th}$ and $12^{th}$ week)
8. Project report assessment by the guide and review panel: 2 Weeks ($13^{th}$ and $14^{th}$ week)
9. Final Evaluation/Examination Presentation: $15^{th}$ week

**Project Demonstration (50 Marks)**

1. **Review 1 (05 marks)**
   - Demonstrate an ability to define precise Problem Statement, Project objectives and Scope, Project Planning, application of Project management tools.
2. **Project Activities (05 Marks)**
   - Demonstrate an ability to identify situations of unethical professional conduct and propose ethical alternatives.
   - Demonstrate Commitment towards practicing the Professional Ethics and moral.
   - Demonstrate an ability to apply the Code of Ethics
3. **Review 2 (Project Modeling and Designing, Block diagram, Flow chart, etc.) (10 marks)**
   - Write detailed Literature Review, Need and Significance of Study, Methodology, Block Diagram, Flow Chart, Engineering drawings, etc.
4. **Project Documentation (10 marks)**
   - Produce clear, well-constructed, and well-supported written engineering documents, project cost sheet and plagiarism report.
5. **Final project demonstration & Project team presentation (20 marks)**
   - Demonstrate effective communication,Implement the norms of standard professional practices, Present results as a team showing the responsible behaviour.

**TEXT BOOKS**


1. Schmidt, T. (2009). Strategic Project Management Made Simple. 2nd Edition, Wiley Pub, India.(ISBN 978-1-119-71817-8)
2. Challender, J. (2022). Professional Ethics in Construction and Engineering", Wiley .(ISBN-13: 978-1-119-83210-2)
3. Rogerson, S. (2003) Computer Ethics and Professional Responsibility. 1st Edition Wiley Blackwell Publication.(ISBN-13: 978-1855548459)
4. Nagarazan, R.S. (2022). A Textbook on Professional Ethics and Human Values. New Age Publication, (ISBN-13: 978-81-224-2301-3)
5. Hering, L. and Hering H. (2005). How to write Technical Reports. Springer (ISBN : 978-3-540-69929-3)


**REFERENCE BOOKS**


1. Zwikael, O. and Smyrk, J. (2019). Project Management A Benefit Realization Approach. Springer Publication, (ISBN-13: 978- 0134877693)
2. Handley, W. (1977). Industrial Safety Handbook. 2nd Revised edition ,McGraw-Hill Companies;, (ISBN-13: 978-0070844810)
3. Mislick, G. and Mussbaum, D. (2015) Cost Estimation: Methods and Tools. Wiley, (ISBN-13: 978-1-118-53613-1)
4. Chilcutt, A. and Adam, J. (2019). Engineered to Speak: Helping You to Create and Deliver Engaging Technical Presentations. Wiley, (ISBN-13: 978-1-119-47496-8)

## E-RESOURCES

1. University of California, free online course: https://www.classcentral.com/course/project-planning-1-12208
2. International Journal of Project Management : https://www.sciencedirect.com/journal/international-journal-of-project-management
3. Free software tool for project Management : https://onlinepmcourses.com/project-management-tools/free-project-management-resources/
4. Research Article: https://doi.org/10.1016/j.tsc.2024.101477
5. Research Article: https://doi.org/10.1016/j.ijproman.2024.102584

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Database Management System |
| | COURSE CODE | 2308216T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Foundation of Computing

## COURSE OBJECTIVES :

2308216T.CEO.1: To learn basic concepts of database management system,database transaction processing,concurrency control and Recovery.
2308216T.CEO.2: To learn key notions of query evaluations and optimization techniques.
2308216T.CEO.3: To develop database design using ER diagram.
2308216T.CEO.4: To develop database design with integrity constraints and Trigger.
2308216T.CEO.5: To understand the normalization techniques.
2308216T.CEO.6: To understand CRUD operations on SQL and NoSQL database

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308216T.CO.1: Illustrate the fundamental concepts of database management system, transaction processing,concurrency control and recovery. [L2]
2308216T.CO.2: Apply notions of query evaluations and optimization techniques. [L3].
2308216T.CO.3: Construct the ER model to solve the given problem[L3].
2308216T.CO.4: Design a well–formed relational database design(Schema) [L3]
2308216T.CO.5: Apply Normalization techniques to relational Schema[L3].
2308216T.CO.6: Execute CRUD operations on relational and non-relational database.[L3]

## COURSE ABSTRACT:

A database management system is a software which allows creation,definition,and manipulation of the database,allowing users to store,process and analyse data easily. The course allows the learners with the learning of complete end to end development of an application developed using the UI and back end technologies.The data has to be mapped to different data models like the ER diagram,relational data model and then this has to be stored back into the database system.For effectively analyzing the stored data some query language is used. Here, in this course, the ORACLE or MYSQL can be used as a database system for storing and managing the data.The database must be created in such away that the data must be retrieved in an efficient manner. For this, the concept of normalization is applied to the database table. Finally, the ACID properties of any database application have to be maintained form a intaining the consistency of the data. The main objective of this course is to apply the basic operation of the database management system on the data generated through some application. Finally,the students must develop an end to end application considering some user requirements by applying front-end and back-end technologies.

## THEORY COURSE CONTENTS

| UNIT 1 | INTRODUCTION | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Banking system,Student Information system using traditional file processing system

**Contents:** Introduction to Database system,Database System Vs file System,Data Abstraction, Instances and Schemas,Data Models- the ER Model,Relational Model,Other Models Mapping ER model to relational model. Case study ERD and Table design,System Structure,Database architectures:Centralized,Client Server,Parallel and Distributed Systems.

**Self Study:** Database Users and Administrator

**Further Readings:** Modeling concept for object oriented and object relational database.

| UNIT 2 | RELATIONAL MODEL | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Relational model for Banking system,University database

**Contents:** Structure of Relational Databases ,Database Schema,Schema Diagrams , Integrity Constraints over Relations-Key Constraints,Foreign Key Constraints,General Constraints,Relational Query Languages–Relational algebra,Tuple relational calculus.

**Self Study:**:Equivalence of relational calculus and relational algebra.

**Further Readings:**Domain relational calculus.

| UNIT 3 | STRUCTURE QUERY LANGUAGE | 08 HOURS |
|---|---|---|

**Applications/Case Study:** SQL queries for Banking system, shop management system,Tiwtter data analysis

**Contents:** SQL Queries–Nested queries–Aggregate operators–Null values,Views,Index,PL/SQL block,exceptions,packages, looping,Concept of stored procedures,cursor,Triggers.

**Self Study:** Transaction control language–commit,Rollback,savepoints.

**Further Readings:**Recursive Queries

| UNIT 4 | DATABASE DESIGN AND QUERY PROCESSING | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Student Information system,Employee database system

**Contents:** Relational Database Design: Purpose of Normalization,Data Redundancy and Update Anomalies,Functional Dependencies. Decomposition–Armstrong's axiom. The process of Normalization: 1NF,2NF,3NF,BCNF.Query Processing:Overview,Measures of Query cost,Selection and Join operations,Evaluation of Expressions.

**Self Study:** Multi valued dependency,4NF

**Further Readings:**XML and web databases

| UNIT 5 | TRANSACTION MANAGEMENT | 08 HOURS |
|---|---|---|

**Applications/Case Study:** ATM system,Banking system

**Contents:** Basic concept of a Transaction, ACID Properties, Database Architecture, Concept of Schedule, Serial Schedule. Serializability: Conflict and View, Cascaded aborts Recoverable and Non- recoverable Schedules. Concurrency Control:Need Locking methods,Deadlocks,Time stamping Meth- ods. Different crash recovery methods: Shadow-Paging, Log-based Recovery: Deferred and Immedi- ate,CheckPoint.

**Self Study:** Buffer management and remote backup

**Further Readings:** ARIES Recovery

| UNIT 6 | NOSQL DATABASES | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Aadhar UIDAI system

**Contents:** Introduction to NOSQL database,Types of NoSQL Databases,ACID vs BASE,SQL vs No-SQL,MongoDB:Data Types,Documents,Collections,Database,CRUD Operations,Aggregation

**Self Study:** Pipeline and Indexing.

**Further Readings:** Multimedia Databases..

## TEXT BOOKS


1. Silberschatz A.,Korth H.,Sudarshan S.Database System Concepts. 6th Edition,McGrawHill Publishers,2006, ISBN978-0-07-352332-3.
2. Elmasri R., Navathe S., Fundamentals of Database Systems.4th Edition, Pearson, Education, 2003, ISBN8129702282D.
3. Pramod J Sadalage,Martin Fowler,NoSQL-Abrief guide to the Emerging World of Polyglot Persistence Distilled.Addison-Wesley, ISBN978-0-321-82662-6.
4. Raghu ramaKrishnan,Johannes Gehrke DatabaseManagement Systems3/e,TMH


## REFERENCE BOOKS


1. Rab P.Coronel C.Database Systems Design, Implementation and Management. 5th Edition,
2. Connally T.,Begg C .Database Systems3rd Edition,Pearson Education,2002,ISBN81-7808-861 4M.
3. Thoms on CourseTechnology,2002, ISBN981-243-135-7. .Date C., An Introduction to Database Systems 7th Edition,Pearson Education, 2002,ISBN81-7808-23
4. H Garcia-Molina, JD Ullman and Widom, Database Systems: The Complete Book 2ndEd.,PrenticeHall


## E-RESOURCES

1. https://nptel.ac.in/courses/106106220
2. https://www.w3schools.com/sql/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Database Management System Lab |
| | COURSE CODE | 2308216L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Foundation of Computing

## COURSE OBJECTIVES :

2308216L.CEO.1: To develop database design using ER diagram.
2308216L.CEO.2: To develop database design with integrity constraints and Trigger.
2308216L.CEO.3: To understand the normalization techniques.
2308216L.CEO.4: To understand CRUD operations on SQL and NoSQL database.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308216L.CO.1: Construct the ER model to solve the given problem [L3].
2308216L.CO.2: Design a well –formed relational database design(Schema) [L3].
2308216L.CO.3: Apply Normalization techniques to relational Schema [L3].
2308216L.CO.4: Execute CRUD operations on relational and non-relational database.[L3]

**COURSE ABSTRACT:**

A database management system is a software which allows creation, definition, and manipulation of the database, allowing users to store, process and analyse data easily. The course allows the learners with the learning of complete end to end development of an application developed using the UI and backend technologies. The data has to be mapped to different data models like the ER diagram, relational data model and then this has to be stored back into the database system. For effectively analyzing the stored data some query language is used. Here, in this course, the ORACLE or MY SQL can be used as a database system for storing and managing the data. The database must be created in such a way that the data must be retrieved in an efficient manner. For this, the concept of normalization is applied to the database table. Finally, the ACID properties of any database application have to be maintained for maintaining the consistency of the data. The main objective of this course is to apply the basic operation of the database management system on the data generated through some application. Finally, the students must develop an end to end application considering some user requirements by applying front-end and back-end technologies.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **.** | **4 HOURS** |
| Design and draw an ER/EER diagram using standard notations for given problem definition and convert this diagram into Database Tables.Be sure to underline all primary keys, include all necessary foreign keys and indicate referential integrity constraints | | |
| **PRACTICAL NO.02** | | **10 HOURS** |
| For above example use SQL DML statement such as INSERT,UPDATE and DELETE to insert the data into tables and to update/delete the data inserted into/from tables. Write and execute SQL queries to extract information from the table. | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Create and perform Database Operations using Oracle as Back End and Java as Front End.Use JDBC connectivity. | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Implement following different types of PL/SQL blocks 1. Anonymous PL/SQLblock 2. Anonymous PL/SQL with cursor concept and Exception handling 3. Anonymous PL/SQL with For loop cursor concept4. Stored Procedure and Function 5.Trigger | | |
| **PRACTICAL NO.05** | **.** | **4 HOURS** |
| Design unstructured database and perform different operations on it. | | |
| **PRACTICAL NO.06** | **.** | **4 HOURS** |
| MINIPROJECT:Database Project Life Cycle Students have to complete a miniproject in agroup of minimum 3 and maximum 4 students.The problem statement for the project will be given to each group by the instructor in the first week of semester. Students can use either of the database systems (structured or unstructured)for completing their project . | | |

## TEXT BOOKS


1. Silberschatz A.,Korth H.,Sudarshan S.Database System Concepts. 6th Edition,McGraw Hill Publishers,2006, ISBN978-0-07-352332-3.
2. Elmasri R., Navathe S., Fundamentals of Database Systems.4th Edition, Pearson, Education, 2003, ISBN8129702282D.
3. Pramod J Sadalage,Martin Fowler,NoSQL-Abrief guide to the Emerging World of Polyglot Persistence Distilled.Addison-Wesley, ISBN978-0-321-82662-6.
4. Raghu ramaKrishnan,Johannes Gehrke DatabaseManagement Systems3/e,TMH


## REFERENCE BOOKS


1. Rab P.Coronel C.Database Systems Design, Implementation and Management. 5th Edition,
2. Connally T.,Begg C .Database Systems3rd Edition,Pearson Education,2002,ISBN81-7808-861 4M.
3. Thoms on CourseTechnology,2002, ISBN981-243-135-7. .Date C., An Introduction to Database Systems 7th Edition,Pearson Education, 2002,ISBN81-7808-23
4. H Garcia-Molina, JD Ullman and Widom, Database Systems: The Complete Book 2ndEd.,PrenticeHall


## E-RESOURCES

1. https://nptel.ac.in/courses/106106220
2. https://www.w3schools.com/sql/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | ADVANCE DATA STRUCTURES |
| | COURSE CODE | 2308219T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE KNOWLEDGE :** Data Structures

**COURSE OBJECTIVES :**

2308219T.CEO.1: Introduce various data structures like trees, graphs, heaps, hash tables, disjoint sets etc.

2308219T.CEO.2: Demonstrate how to select appropriate data structures based on requirement of application.

2308219T.CEO.3: Discuss about the implementation of various real world applications using data structures.

2308219T.CEO.4: Explain about the evaluation of performance of data structures in terms of time and space complexity.

2308219T.CEO.5: Learn how to design own data structure using standard data structures.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308219T.CO.1: Illustrate the working of advanced data structures namely trees, graphs, heaps,d isjoint sets, hash tables, probabilistic data structures[L3].

2308219T.CO.2: Demonstrate the advantages and disadvantages of various data structures [L3].

2308219T.CO.3: Choose appropriate data structures to build applications for given real world problem statements [L3].

2308219T.CO.4: Develop various applications for specified problems using data structures such as trees, graphs and heaps [L3].

2308219T.CO.5: Evaluate performance of various data structures in terms of time and space complexity [L4].

2308219T.CO.6: Design own data structures using the built in data structures [L4].

## COURSE ABSTRACT:

A good algorithm usually comes together with a set of good data structures that allow the algorithm to manipulate the data efficiently. The course Advance Data structures focuses on developing important technical concepts in the theories and practical applications of Data structures. Students will delve into the fundamental concepts of Trees, Balanced Trees, Graphs, Heaps, Disjoint sets, Hashing, Probabilistic data structures.

## THEORY COURSE CONTENTS

| UNIT 1 | TREES | 09 HOURS |
|---|---|---|

**Applications/Case Study:** Parse trees and expression trees in Compiler.

**Contents:**Introduction to trees, Tree Terminology, General trees, Binary trees, KD tree, Tree as ADT, Conversion of general tree into binary tree, Representation of tree using sequential and linked list, Binary tree and its types, Properties of Binary trees, Binary search tree and operations on binary search tree, Depth First and Breadth First traversal, Tree traversal techniques: inorder, preorder, postorder traversal (recursive and non-recursive traversal),Threaded Binary Tree-concept, Operations on TBT( insert, delete, search, update and traversal), Time complexity and space complexity for tree operations, Applications of trees.

**Self Study:** Game trees

**Further Readings:** Optimal Binary Search Tree.

| UNIT 2 | HEIGHT BALANCED AND MULTIWAY TREES | 06 HOURS |
|---|---|---|

**Applications/Case Study:** BTRFS File System.

**Contents:** Height balanced trees concepts ,Types of height balanced trees and applications, AVL Trees and operations, Multiway trees: concepts, Types of multiway trees: B and B+ Trees operations on multiway trees and applications, Time complexity and space complexity for tree operations.

**Self Study:** Red Black Tree ,Trie Tree, Splay Tree.

**Further Readings:**: AA Trees and range queries..

| UNIT 3 | GRAPHS | 05 HOURS |
|---|---|---|

**Applications/Case Study:** Packet routing in networks.

**Contents:** Graph Concepts, Terminology,Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals - depth first and breadth first, Minimum spanning Tree, Prims and Kruskal Algorithms, Dikjtra's Single source and multi-source shortest path, Topological ordering applications of graphs.

**Self Study:** Warshall's algorithm..

**Further Readings:** Algorithms for connected components.

| UNIT 4 | HEAPS AND DISJOINT SETS | 05 HOURS |
|---|---|---|

**Applications/Case Study:** APriority queue.

**Contents:** Concept of Heaps, Types of heap, Operations on Heap – insert, delete, up-heapify and downheapify, use of heap in heap-sort, Fibonacci heap. Concept of Disjoint Sets, Disjoint Sets as ADT, Up Trees, Smart Union and Path compression.

**Self Study:** Binomial heap

**Further Readings:** Multidimensional Heaps.

| UNIT 5 | PROBABILISTIC DATA STRUCTURES | 05 HOURS |
|---|---|---|

**Applications/Case Study:** Recommendation System

**Contents:** Probabilistic data structures concept and Types of Probabilistic data structures: Member-ship Bloom Filters, Cuckoo Filters, Cardinality: Linear counting, HyperLogLog, Frequency: Count-Min Sketch , Similarity: Minhash, SkipLists , Applications of Probabilistic data structure structures.

**Self Study:**Counting Bloom Filter.

**Further Readings:** q-digest and t-digest data structures for ranking.

## TEXT BOOKS


1. Horowitz, Ellis, Sartaj Sahni, and Dinesh Mehta. (2008). *Fundamentals of data structures*. 2nd Edition, Universities Press . ISBN 978-8173716065.
2. Samanta, Debasis. (2009). *Classic data structures*. 2nd Edition, Prentice Hall India. ISBN 978-8120337312.
3. Brass, Peter. (2014). *Advanced data structures*. 2nd Edition, Cambridge University Press. ISBN 978-1107439825.


## REFERENCE BOOKS


1. Cormen, Thomas H., et al.(2009). *Introduction to Algorithms*. 3rd Edition, MIT Press. ISBN: 978-0262533058.
2. Gakhov, Andrii (2019). *Probabilistic Data Structures and Algorithms for Big Data Applications*. ISBN:978-3748190486


## E-RESOURCES

1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106106133
3. https://www.cse.iitb.ac.in/ ranade/cs213/
4. https://ocw.mit.edu/courses/6-851-advanced-data-structures
5. https://www.cs.bham.ac.uk/ jxb/DSA/dsa.pdf
6. https://www.cs.jhu.edu/ jason/226/
7. https://courses.csail.mit.edu/6.851/spring21/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | ADVANCE DATA STRUCTURES LAB |
| | COURSE CODE | 2308219L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Data Structures

**COURSE OBJECTIVES :**

2308219L.CEO.1: Introduce various data structures like trees, graphs, heaps, hash tables, disjoint sets etc.

2308219L.CEO.2: Demonstrate how to select appropriate data structures based on requirement of application.

2308219L.CEO.3: Discuss about the implementation of various real world applications using data structures.

2308219L.CEO.4: Explain about the evaluation of performance of data structures in terms of time and space complexity.

2308219L.CEO.5: Learn how to design own data structure using standard data structures.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2308219L.CO.1: Choose appropriate data structures for solving a given problem statement [L3].
2308219L.CO.2: Develop functions to implement various operations to be performed using appropriate data structures [L3].
2308219L.CO.3: Demonstrate advantages and disadvantages of various data structures [L3].
2308219L.CO.4: Implement program for given real world problem using suitable data structures [L3].
2308219L.CO.5: Analyze the efficiency of different data structures for specified problem statement[L4].

**COURSE ABSTRACT:**

A good algorithm usually comes together with a set of good data structures that allow the algorithm to manipulate the data efficiently. The course Advance Data structures focuses on developing important technical concepts in the theories and practical applications of Data structures. Students will delve into the fundamental concepts of Trees, Balanced Trees, Graphs, Heaps, Disjoint sets, Hashing, Probabilistic data structures.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **BINARY SEARCH TREE** | **6 HOURS** |
| Design and develop a program in C++ to implement the following operations on Binary Search Tree: create, inorder traversal, preorder traversal, postorder traversal(for both recursive and non-recursive),delete a node, insert a node and level wise printing. | | |
| **PRACTICAL NO.02** | **THREADED BINARY TREE** | **4 HOURS** |
| Write a program in C++ to implement the following operations on Threaded Binary Tree : create, inorder traversal, preorder traversal, postorder traversal, inorder traversal, preorder traversal, postorder traversal(both recursive and non-recursive) . | | |
| **PRACTICAL NO.03** | **AVL TREE** | **6 HOURS** |
| Write a program in C++ to implement the following operations on AVL Trees: create, recursive inorder traversal, recursive preorder traversal, recursive postorder traversal, non recursive inorder traversal, non recursive preorder traversal, non recursive postorder traversal. | | |
| **PRACTICAL NO.04** | **MINIMUM SPANNING TREE.** | **4 HOURS** |
| Write a program in C++ to find the minimum spanning tree of a given graph using Prim's and Kruskal's algorithm. | | |
| **PRACTICAL NO.05** | **HEAPS** | **4 HOURS** |
| Write a program in C++ to implement heap sort algorithm to sort the given numbers in ascending and descending order | | |
| **PRACTICAL NO.06** | **PROBABILISTIC DATA STRUCTURES** | **6 HOURS** |
| Write a program in C++ to implement the following probabilistic data structures Bloom's Filter, and count-min sketch. | | |

## TEXT BOOKS


1. Horowitz, Ellis, Sartaj Sahni, and Dinesh Mehta. (2008). *Fundamentals of data structures*. 2nd Edition, Universities Press . ISBN 978-8173716065.
2. Samanta, Debasis. (2009). *Classic data structures*. 2nd Edition, Prentice Hall India. ISBN 978-8120337312.
3. Brass, Peter. (2014). *Advanced data structures*. 2nd Edition, Cambridge University Press. ISBN 978-1107439825.


## REFERENCE BOOKS


1. Cormen, Thomas H., et al.(2009). *Introduction to Algorithms*. 3rd Edition, MIT Press. ISBN: 978-0262533058.
2. Gakhov, Andrii (2019). *Probabilistic Data Structures and Algorithms for Big Data Applications*. ISBN:978-3748190486


## E-RESOURCES

1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106106133
3. https://www.cse.iitb.ac.in/ ranade/cs213/
4. https://ocw.mit.edu/courses/6-851-advanced-data-structures
5. https://www.cs.bham.ac.uk/ jxb/DSA/dsa.pdf
6. https://www.cs.jhu.edu/ jason/226/
7. https://courses.csail.mit.edu/6.851/spring21/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | THEORY OF COMPUTATION |
| | COURSE CODE | 2308220T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** Requires knowledge of Discrete Structure

## COURSE OBJECTIVES :

2308220T.CEO.1: To provide a comprehensive understanding of the fundamental concepts of theoretical computer science.

2308220T.CEO.2: To construct formal mathematical proofs for the correctness of algorithms and computational methods.

2308220T.CEO.3: To demonstrate the connection between automata and formal language theory and problem solving.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308220T.CO.1: Differentiate between all types of automata models, by analyzing their capabilities and limitations in solving computational problems. [L4]

2308220T.CO.2: Construct different kinds of grammars, automata from languages and from one to the other.[L3]

2308220T.CO.3: Apply formal mathematical methods to prove properties of languages, grammars and automata.[L3]

2308220T.CO.4: Decide on the appropriate type of automaton required to recognize a given language based on its structural complexity and properties.[L5]

2308220T.CO.5: Compare and contrast decidability of problems based on their properties.[L4]

**COURSE ABSTRACT:**

The Theory of Computation course covers foundational concepts in computer science, including finite automata, regular expressions, and context-free grammars, which are used to model and recognize patterns in strings and languages. Additionally, the course explores more advanced topics such as pushdown automata and Turing machines, which are models of computation capable of solving more complex problems. Students delve into topics of decidability, which concerns the question of whether certain problems can be solved algorithmically, and complexity theory, which analyzes the efficiency of algorithms and classifies problems based on their computational difficulty. Overall, the course provides students with a deep understanding of the theoretical aspects of computation, enabling them to analyze and solve problems in computer science with rigor and precision.

**THEORY COURSE CONTENTS**

| UNIT 1 | FINITE AUTOMATA | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Working of Vending Machines, Parking Lot Gate Control System.

**Contents:** Introduction to Complexity Theory, computability Theory and Automata Theory , String, Alphabet and Languages, Regular Languages, Finite state Machines, Deterministic and Non Deterministic Finite state Machines, Epsilon NFA, Equivalence of the three Models, Minimization of Finite Automata, Finite Automata with output (Moore and Mealy Machines- Definitions, Models and Inter Conversion).

**Self Study:** Myhill-Nerode theorem.

**Further Readings:** Timed Automata, Hidden Markov Model, Transducers in NLP.

| UNIT 2 | REGULAR EXPRESSION | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Pattern Matching, Grep utility of Linux, Text Processing and Search.

**Contents:** Operators of Regular Expression, Precedence of Operators, Building Regular Expression, Algebraic Laws for Regular expression, Conversions: RE to NFA-DFA using Thompson's construction, DFA to RE using Arden's theorem, State Elimination Method. Use of Regular Expression in practical programming, Regular expression equivalence Closure Properties of Regular languages, Pumping Lemma for Regular Languages.

**Self Study:**Decision properties of RE, Application of regular expressions in Lexical Analysis, Web scrapping

**Further Readings:**Regular expression in information retrieval, Exploring online interactive tools for regular expression validation and testing. (ex. RegexPal,RegExr, Regex101.)

| UNIT 3 | CONTEXT FREE GRAMMAR | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Design of Parser for Compilers or Interpreters/ Web crawler.

**Contents:** Context Free Language Models, context free grammars, Ambiguous Grammar, Removing ambiguity, Simplification of CFG, Chomsky Normal Form(CNF), Greibach Normal Form(GNF), Closure Properties, Chomsky Hierarchy, Regular Grammar.

**Self Study:** Application of CFGs in XML and DTD, Decision Properties of CFL.

**Further Readings:**Exploring web-based CFG tools, Chart parsing, CYK parsing, Early parsing.

| UNIT 4 | PUSHDOWN AUTOMATA | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Parsing Arithmetic Expressions with Pushdown Automata (PDA).

**Contents:** Introduction to Pushdown Automata, Pushdown Automata Design, Deterministic Pushdown Automata, Non – Deterministic Pushdown Automata Design, Pushdown Automata to Context free grammar and Vice Versa, Closure properties. Pumping lemma for context-free languages.

**Self Study:** Multi – Stack Push Down Automata

**Further Readings:**Post Machines, Linear Bounded Automata,Python Libraries (PDAsim, PDAteach)

| UNIT 5 | TURING MACHINE | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Memcomputing, Von Neuman Architecture

**Contents:** Introduction to Turing Machines, Relationship to other automata models (Finite Automata, Pushdown Automata), Components of Turing Machines, Designing T.M for different set of problems, Universal T.M, Recursive Sets, Church's T.M, Halting Problem.

**Self Study:** Multi Tape Turing Machines, Explore the Online Turing Machine Simulator TM Visualization.

**Further Readings:** Non Deterministic Turing Machine,Explore the Online Turing Machine Simulator and TM Visualization.

| UNIT 6 | DECIDABILITY AND COMPLEXITY THEORY | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Travelling Salesman Problem, Hamiltonian Cycle Problem.

**Contents:** Introduction to Decidability, Decidable and Undecidable language, Decidable problems concerning regular languages and Undecidable Problems: Post's correspondence problem, non-recursively enumerable language, Introduction to Complexity Theory, Computational complexity classes (P, NP, NP-hard, NP-complete), Polynomial-Time Reductions, NP-Completeness, Tractable and Intractable Problems, and Representing Satisfiability

**Self Study:** 3 SAT Problem

**Further Readings:** Simple Reducibility Problem.

## TEXT BOOKS


1. John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman (2008). *Introduction to Automata Theory Languages And Computation*. 3rd Edition, Pearson.ISBN 978-8131720479
2. Michael Sipser (2014). *Introduction to the Theory of Computation*. 3rd Edition, Cengage Learning.ISBN-13: 978-131525296
3. Dexter C. Kozen (2013). *Automata and Computability*. 1st Edition, Springer Publishers.ISBN 978-3642857065.


## REFERENCE BOOKS


1. Vivek Kulkarni(2013). *Theory of Computation*. 1st Edition, Oxford University Press,ISBN: 978-0198084587
2. George Tourlakis (2014).*Theory of Computation*. 1st Edition, Willey,ISBN:978-1118315354


## E-BOOKS/E-CONTENTS LINKS (if any)

1. Theory of Computation By Anil Maheshwari and Michiel Smid Carleton University
2. https://nptel.ac.in/courses/106/104/106104148/
3. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman,"Introduction to Automata Theory Languages and Computation

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | Object Oriented Programming (Core Java) |
| | **COURSE CODE** | 2308268L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE KNOWLEDGE :** Problem Solving Using OOP(CPP)

## COURSE OBJECTIVES :

2308268L.CEO.1: To design and program stand-alone Java applications.
2308268L.CEO.2: To extend Java classes with inheritance and dynamic binding.
2308268L.CEO.3: To use exception handling and file handling in Java applications.
2308268L.CEO.4: To design a graphical user interface (GUI) with Java Swing.
2308268L.CEO.5: To implement database applications.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308268L.CO.1: Implement Object Oriented Programming Concepts in java. [L3]
2308268L.CO.2: Construct packages and interfaces in Java[L3]
2308268L.CO.3: Develop GUI-based java applications. [L3]
2308268L.CO.4: Utilize logic building traits efficiently for solving real life problems. [L3]
2308268L.CO.5: Implement applications using JDBC [L3]

## COURSE ABSTRACT:

Core Java is the Skill Development Course. The basic aim of the course is to introduce the students to Object Oriented Programming using Java. and make their concepts clear for designing real time applications using the same. The inclusion of Challenging Problems in the course will enhance students' logical thinking and boost their analytical skills. Various stages in problem solving will help students to deal with complex problems easily. This course will improve students problem solving abilities and coding skills.

## CONTENTS :

Basics of Java, Data Types and Variables, Operators, Control Statements,Looping, Arrays; String, String Buffer, String Builder; Methods, Lambda Expression, Constructor; Object Oriented Program- ming System : Classes and Objects, Modifiers, Inner Classes; Inheritance; Super,This,Static and Final Keywords; Polymorphism: Method Overloading, Method Overriding; Abstraction, Interfaces; Excep- tion Handling, Create Own Exceptions; Multi threading ; Packages, Collections Framework; File Han- dling; Generics; Introduction to Swing: Layout Management , Swing Components ,Text Fields , Text Areas ,Buttons, Check Boxes, Radio Buttons , Lists, Choices, Scroll bars , Windows ,Menus , Dialog Boxes. JDBC Programming .

Self Study: Bytecode in Java ,Bytecode vs Machine code, JRE, Java API, JVM in Java, JVM Architecture, Class Loader,Interpreter in Java Interpreter vs Compiler,Download Install Java Development Kit JDK,Download Eclipse IDE for Java Developers.

| PRACTICAL: All assignments should be performed considering real-world applications. | | |
|---|---|---|
| **PRACTICAL NO.01** | **FUNDAMENTALS OF JAVA** | **6 HOURS** |
| a) Write a program based on the basics of Java<br>b) Implement a program using Control Statement, Looping, Array<br>c) Program for implementing string operations | | |
| **PRACTICAL NO.02** | **CLASS-OBJECT, METHODS, CONSTRUCTORS** | **6 HOURS** |
| a) Write a program to create Class, declare Member Variables, Define Methods<br>b) Program to define Constructor, Passing Information to a Method or a Constructor. | | |
| **PRACTICAL NO.03** | **JAVA INHERITANCE** | **4 HOURS** |
| a) Program to implement all types of Inheritance<br>b) Write a Java program to create a base class Sports with a method called play(). Create three subclasses: Football, Basketball, and Rugby. Override the play() method in each subclass to play a specific statement for each sport. | | |
| **PRACTICAL NO.04** | **STATIC, FINAL , SUPER AND THIS KEYWORD** | **2 HOURS** |
| a) Program to implement static, final , super and this keyword in java | | |
| **PRACTICAL NO.05** | **POLYMORPHISM** | **4 HOURS** |
| a) Program to implement polymorphism<br>b) Write a Java program to create a class Vehicle with a method called speedUp(). Create two subclasses Car and Bicycle. Override the speedUp() method in each subclass to increase the vehicle's speed differently. | | |
| **PRACTICAL NO.06** | **JAVA ABSTRACT CLASS, INTERFACES, LAMBDA EXPRESSION** | **4 HOURS** |
| a) Write a program based on Abstract Class<br>b) Write a program based on Interfaces<br>c) Program to define lambda expression | | |
| **PRACTICAL NO.07** | **EXCEPTION HANDLING** | **4 HOURS** |
| a) Implement a program to handle different exceptions<br>b) Implement a program to create own exception class | | |

| PRACTICAL NO.08 | JAVA THREAD | 4 HOURS |
|---|---|---|
| a) Write a Java program to create a basic Java thread that prints ”Hello, World!” when executed.<br>b) Write a Java program that creates two threads to find and print even and odd numbers from 1 to 20. | | |
| **PRACTICAL NO.09** | **PACKAGES AND COLLECTIONS** | **4 HOURS** |
| a) Implement a program to create own package<br>b) Implement a program based on Java collections | | |
| **PRACTICAL NO.10** | **FILE HANDLING** | **4 HOURS** |
| a) Write a Java program to get a list of all file/directory names in the given directory.<br>b) Write a Java program to read file content line by line. | | |
| **PRACTICAL NO.11** | **JAVA SWING** | **4 HOURS** |
| a) Write a program to create Frame and make use of Layout Management, User Interface Components<br>b) Write a program to create GUI based application using swing | | |
| **PRACTICAL NO.12** | **JDBC** | **6 HOURS** |
| a) Write a JDBC application which will interact with Database and perform the following task.<br>1) Create Student Table with RollNo, Name, and Address field and insert few records.<br>2) Display the content of Record.<br>3) Insert Two Records.<br>4) Update One Record.<br>5) Delete One Record. | | |
| **PRACTICAL NO.13** | **JAVA GENERICS** | **2 HOURS** |
| a) Write a Java program to create a generic method that takes two arrays of the same type and checks if they have the same elements in the same order<br>b) Write a Java program to create a generic method that takes a list of numbers and returns the sum of all the even and odd numbers. | | |

| PRACTICAL NO.14 | Mini Project: Sample Topics | 6 HOURS |
|---|---|---|

a) Energy billing system

b) Medical store stock management system

c) Gaming Application

d) Library book issue management system

e) Restaurant Management System

f) Online bus reservation system

Implement Using: The concept of Swing and JDBC

**Instructional Method**

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by white board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students
3. A Practical examination will be conducted at the end of the semester for evaluation of the performance of students in the laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, and Virtual Laboratory
5. Only one mini-project is planned to be undertaken by a student. Groups have to be formed for a project, the number of students in the group should not exceed three.
6. Each project should encompass two or three COs. The students need to give the project presentation at the end of the semester for assessment.

## TEXT BOOKS


1. Herbert Schildt.(2021). “Java The complete reference”, 12th Edition, McGraw Hill Education.
2. Cay S. Horstmann, Gary cornell.(2021). “Core Java Volume –I Fundamentals”, 12th Edition, Prentice Hall.


## REFERENCE BOOKS


1. K. Arnold and J. Gosling. (2005).“The JAVA programming language”, Fourth edition, Pearson Education.
2. Timothy Budd. (2000). “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education.
3. C. Thomas Wu. (2006). “An introduction to Object-oriented programming with Java”, Fourth Edition, Tata McGraw-Hill Publishing company Ltd.


## E-RESOURCES

1. https://nptel.ac.in/courses/106105191

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | Enterprise Application Development (Advanced Java) |
| | **COURSE CODE** | 2308269L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Requires knowledge of Problem Solving Using OOP(Java)

## COURSE OBJECTIVES :

2308269.CEO.1: To Apply the core Java fundamentals to learn the advanced concepts in J2SE

2308269.CEO.2: To make use of Servlet and JSP API in the process of enterprise application deployment

2308269.CEO.3: To Development of web application having collaboration of Servlets, JSPs, JSF, Spring and Hibernate based upon the requirement.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2308269.CO.1: Construct java applications using OOP, JDBC and multithreading concepts. [L3]

2308269.CO.2: Utilize Servlet and JSP API in the process of enterprise application deployment. [L3]

2308269.CO.3: Build web application using Servlets, JSPs, Spring, Hibernate, and database, based upon the requirement. [L3]

2308269.CO.4: Develop programs using socket programming [L3]

## COURSE ABSTRACT:

The Skill Development Course offered for SY BTECH Students. Based on object-oriented concepts and Advanced Java concepts, this course will equip the students with the required knowledge and skill of object-oriented programming approach needed for the development of robust, powerful web applications. This course develops the programming ability of students to create dynamic web applications using server-side technology with Java Database Connectivity. Students can learn networking and remote method invocation using Java API. Different Java frameworks like Spring, Java Server Faces, and Hibernate will increase the ability of students in web application development.

## CONTENTS :

1. J2EE and Web Development
2. JDBC Programming
3. Multithreading
4. Networking
5. Servlet
6. Java Server Pages (JSP)
7. Hibernate
8. Java Web Frameworks: Spring
9. Java Server Faces

**PRACTICAL: All assignments should be performed considering real-world applications.**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Core Java Fundamentals** | **4 HOURS** |

a) Write a program using Exception Handling, Abstraction, and Package

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **JDBC** | **4 HOURS** |

a) Write a JDBC application which will interact with Database and perform the following task.

1) Create Student Table with RollNo, Name, and Address field and insert few records.

2) Display the content of Record.

3) Insert Two Records.

4) Update One Record.

5) Delete One Record.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Multithreading** | **6 HOURS** |

a) Implement a program to Create thread, scheduler, thread methods all

b) Program to implement thread using runnable interface and creating multiple thread

c) Write a program to priorities of thread, Thread pool, thread group.

| PRACTICAL NO.04 | Networking | 6 HOURS |
|---|---|---|

a) Write a program to retrieve IP address for given website and content of the given URL

b) Implement a program to connection-oriented communication and connection-less communication.

**Practice Problem:** 1)Write a java networking program to create a chat application using Connection-oriented communication.

| PRACTICAL NO.05 | Servlet | 8 HOURS |
|---|---|---|

a) Write a program for simple servlet, testing servlet and deployment descriptor

b) Implement program using doget and doPost method, life cycle of servlet.

c) Write a program to create servlet file for different database operation.

d) Implenet a program for error handling, authentication and context interface

**Practice Problem:** 1) Create an Employment Registration form and display the values entered by the user in another page using servlet.

2) Write a servlet program to store and display student details data from a student database table.

3) Write a Servlet program for checking voting eligibility of users and displaying appropriate messages.

| PRACTICAL NO.06 | Java Server Pages (JSP) | 6 HOURS |
|---|---|---|

a) Write a program based on JSP actions and Objects

b) Implement a program for cookies handling and session tracking

c) Write a program to demonstrate the core, format, function, and SQL tags of JSTL

**Practice Problem:** 1) Write a JSP program to create a simple user login page and display appropriate messages to demonstrate URLRewriting using sendRedirect .

2) Write a JSP program to calculate and pay the electricity bill generated given total units consumed and cost per unit as input from user

3) Write a JSP program to enter the marks of five subjects and display the result using the include directive.

| PRACTICAL NO.07 | Hibernate | 6 HOURS |
|---|---|---|

a) Program to implement Hibernate.

b) Implement Hibernate Annotations.

c) Implement Hibernate Query Language and types of relation

**Practice Problem:** 1) Write a hibernate program to create a Grocery database to store information of products like Product id, name, category, price per quantity, total quantity, quantity sold, quantity left, total price and total sales. Store the record of 20 products belonging to 5 different categories and display the following information (Apply Suitable Annotations). i) Record of all products. ii) Record of all products with sales greater than 50000.

2) Write a hibernate program to create an Employee database to store information of employees like employee id, name, department, designation, manager, salary , tax payable, date of joining. Store the record of 20 employees and display the following information (Apply Suitable Annotations). i) Record of all employees ii) Record of employee with salary greater than 35000

| PRACTICAL NO.08 | Java Web Frameworks: Spring | 8 HOURS |
|---|---|---|

a) Write a program to implement MVC using Spring Framework.

b) Write a program for Inject Service using Aspect Oriented Programming.

c) Implement Jdbc Template,Spring ORM, Spring MVN

d) Implement a program for Spring Template manages, Spring Transaction Management, Spring Restful Services

**Practice Problem:** 1) Write a Spring MVC program to create a Bank Account Registration form and implement data modeling from view to controller to view again using Model and View class and RequestParam Annotation.

2) Write a Spring MVC program to create a Blood Donation Registration form and implement data modeling from view to co13.Write a Spring MVC program to create a Bank Account Registration form and implement data modeling from view to controller to view again using Model object class and RequestParam Annotation.

3) Write a Spring ORM program to implement menu driven program for a Grocery Store and perform following operations i) Adding new Grocery Items ii) Display information of all Grocery Item

4) Write a Spring ORM program to implement menu driven program for a Online Food Ordering System and perform following operations i)Adding new Food Items ii) Display information of all Food Item

| PRACTICAL NO.09 | Java Server Faces | 4 HOURS |
|---|---|---|

a) Write a program for JSF Standard Components and Facelets Tags.

b) Write a program for JSF Converter Tag and Validation Tags.

| PRACTICAL NO.10 | Mini Project: Sample Topics | 8 HOURS |
|---|---|---|

a) Energy billing system

b) Medical store stock management system

c) Library book issue management system

d) Restaurant Management System

e) Online bus reservation system

**Instructional Method**

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by white board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory.
3. Practical examination will be conducted at the end of the semester for evaluation of performance of students in the laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, and Virtual Laboratory
5. Only one mini-project is planned to be undertaken by a student. Groups have to be formed for a project, the number of students in the group should not exceed three.
6. Each project should encompass two or three COs. The students need to give the project presen- tation at the end of the semester for assessment.

**TEXT BOOKS**


1. Java Server Programming Java EE 7 (J2EE 1.7), Black Book
2. Complete Reference J2EE by James Keogh mcgraw publication


**REFERENCE BOOKS**


1. Professional Java Server Programming by Subrahmanyam Allamaraju, Cedric Buest Wiley Pub- lication
2. Hibernate 2nd edition, Jeff Linwood and Dave Minter, Beginning Après publication
3. JDBC™ API Tutorial and Reference, Third Edition, Maydene Fisher, Jon Ellis, Jonathan Bruce, Addison Wesley
4. Beginning JSP, JSF andTomcat, Giulio Zambon, Apress

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Applied Mathematics |
| | COURSE CODE | 2301254T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PRE-REQUISITE :** NIL

## COURSE OBJECTIVES :

2301254T.CEO.1: To evaluate the rank, eigenvalues and eigenvectors of a matrix and solve the system of equations.

2301254T.CEO.2: To find the basis and dimension of vector spaces.

2301254T.CEO.3: To evaluate the derivative and line integral of complex valued functions.

2301254T.CEO.4: To evaluate the derivative and integration of vector-valued functions.

2301254T.CEO.5: To apply the concepts/laws of vector integral calculus to problems in engineering.

2301254T.CEO.6: To solve theoretically and execute the program on problems of numerical methods using MATLAB.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301254T.CO.1: Evaluate the rank, eigenvalues and eigenvectors of a matrix and solve the system of equations [L4].

2301254T.CO.2: Find the basis and dimension of vector spaces [L3].

2301254T.CO.3: Evaluate the derivative and line integral of complex valued functions [L4].

2301254T.CO.4: Evaluate the derivative of vector-valued functions [L4].

2301254T.CO.5: Evaluate line, surface area and volumes of objects using multiple integrals [L4].

2301254T.CO.6: Examine the given problem and choose appropriate numerical method for finding the solution to problems of interpolation, derivative and integration using MATLAB [L4].

## COURSE ABSTRACT

Applied mathematics involves the application of mathematics to problems which arise in various areas of science, engineering, medicine, finance, forecasting etc. and/or the development of new or improved methods to meet the challenges of new problems. Applied mathematics focuses on the creation and study of mathematical and computational tools broadly applicable in science and engineering, and on their use in solving challenging problems in these and related fields. This course mainly discusses the transform analysis used as a major tool to solve complex differential equations, numerical methods and applications of partial differential equations arising in the diverse areas of engineering and technology. As a part of the studies we emphasize more on real life applications of the topics and based on that different activities are also conducting in timely manner. By doing this we boost the curiosity of the students towards research.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Linear Algebra I** | **9 HOURS** |

**Contents:** Basic Concepts, Matrix Addition, Scalar Multiplication, Matrix Multiplication, Linear Systems of Equations, Rank of a Matrix, Eigenvalues, Eigenvectors, Symmetric Matrices, Skew-Symmetric Matrices, Orthogonal Matrices.

**Self Study:** Gauss Elimination Method.

| | | |
|---|---|---|
| **UNIT 2** | **Linear Algebra II** | **7 HOURS** |

**Contents:** Similarity of Matrices, Digonalization, Vector Spaces, Basis, Dimension of vector spaces, Linear Independence, Inner Product Spaces.

**Self Study:** High Dimensional Spaces.

| | | |
|---|---|---|
| **UNIT 3** | **Functions of Complex Variables** | **8 HOURS** |

**Contents:** Complex Numbers, Complex Plane, Polar Form, Powers, Derivative, Analytic Functions, Cauchy-Riemann Equations, Line Integrals in the Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula.

**Self Study:** Residue Theorem.

| | | |
|---|---|---|
| **UNIT 4** | **Vector Differentiation** | **7 HOURS** |

**Contents:** Vectors in 2-D and 3-D, Scalar Product, Vector Product, Vector/scalar functions and fields, Derivative of vectors, Velocity and Acceleration, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field.

**Self Study:** Vector Identities.

| | | |
|---|---|---|
| **UNIT 5** | **Vector Integration** | **7 HOURS** |

**Contents:** Line Integration, Line Integrals Independent of Path, Double Integrals Green's Theorem in the Plane, Surfaces for Surface Integrals. Surface Integrals, Volume Integrals, Divergence Theorem, Stoke's Theorem.

**Self Study:** Maxwell's Equations.

| UNIT 6 | Numerical Methods | 7 HOURS |
|---|---|---|

**Contents:** Numerical Differentiation and Integration, Interpolation: Finite Differences, Newton's and Lagrange's Interpolation. Numerical solution of System of linear equations by Gauss elimina- tion method, LU- Decomposition method.

**Self Study:** Spline Interpolation.

## TEXT BOOK


1. Erwin Kreyszig, (2015), Advanced Engineering Mathematics, 10 th edition, Wiley Eastern Ltd.
2. Dr. B.V. Ramana, (2017), Higher Engineering Mathematics, 5 th edition, Tata McGraw Hill.


## REFERENCE BOOK


1. B.S. Grewal, (2018), Higher Engineering Mathematics, 44 th edition, Khanna Publications.


## E-RESOURCES (NPTEL courses)

1. Linear Algebra By Prof. Dilip P. Patil — IISc Bangalore
2. Introduction to Abstract and Linear Algebra By Prof. Sourav Mukhopadhyay — IIT Kharagpur
3. Complex Analysis By Prof. Pranav Haridas — Kerala School of Mathematics
4. Mathematics -:Integral and Vector Calculus
5. Numerical Methods for Engineers By Prof. Niket Kaisare — IIT Madras
6. Numerical Methods By Mansoor P — MES College of Engineering Kuttippuram, Kerala

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Applied Mathematics Lab |
| | COURSE CODE | 2301254L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2301254L.CEO.1: To impart the knowledge to the students with MATLAB software.
2301254L.CEO.2: To give students a basic understanding of MATLAB, including popular toolboxes.
2301254L.CEO.3: To enhance programming knowledge in Research and Development.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301254L.CO.1: Apply MATLAB conventions to solve engineering-related problems [L3].
2301254L.CO.2: Interpret basics of MATLAB to analyse and visualize data [L5].

## COURSE ABSTRACT

The course utilizes the MATLAB environment to provide students with a working knowledge of computer-based problem-solving methods relevant to science and engineering, including programming and numerical analysis techniques. Students outline, write, test, and debug computer programs to solve problems and display results, with emphasis on proper documentation of computer code. Common examples and applications of engineering are used throughout the course.

| **PRACTICAL: Any 10 practicals are performed as per the requirement of a branch.** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Introduction to MATLAB: Syntax, keywords, matrices, polynomials, loops. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Introduction to MATLAB: In-built functions, 2D/3D plots, creating simple programs. | | |
| **PRACTICAL NO.03** | | **2 HOURS** |
| Finding Laplace transforms of functions, solution of differential equations using Laplace transforms/ Row Spaces. | | |
| **PRACTICAL NO.04** | | **2 HOURS** |
| Finding Fourier transforms of functions, Plotting of transforms/ Null Spaces. | | |
| **PRACTICAL NO.05** | | **2 HOURS** |
| Numerical Integration: Trapezoidal, Simpson's 1/3rd and Simpson's 3/8th rule. | | |
| **PRACTICAL NO.06** | | **2 HOURS** |
| Interpolation techniques: Lagrange's Interpolation. | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Interpolation techniques: Newton's Interpolation. | | |
| **PRACTICAL NO.08** | | **2 HOURS** |
| Solution of differential equation by modified Euler's method. | | |
| **PRACTICAL NO.09** | | **2 HOURS** |
| Solution of differential equation by Runge-Kutta method. | | |
| **PRACTICAL NO.10** | | **2 HOURS** |
| Curve Fitting: Linear, Quadratic. | | |

| PRACTICAL NO.11 | | 2 HOURS |
|---|---|---|
| Solution of algebraic equations: Newton- Raphson method. | | |
| **PRACTICAL NO.12** | | **2 HOURS** |
| Solution of algebraic equations: Bisection method. | | |
| **PRACTICAL NO.13** | | **2 HOURS** |
| Curve Fitting: Cubic, Exponential. | | |

## TEXT BOOK


1. Amos Gilat, (2010), "MATLAB: An Introduction with Applications", 4th edition, Wiley Publication.


## REFERENCE BOOK


1. Ram N. Patel and Ankush Mittal, (2014), "Programming in MATLAB- A Problem solving approach", Pearson Education.


## E-RESOURCES (NPTEL courses)

1. Matlab Programming for Numerical Computation By Prof. Niket Kaisare — IIT Madras
2. Scientific Computing using Matlab By Prof. Mani Mehra, Prof. Vivek K. Aggarwal — IIT Delhi

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF DESIGN | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Prototyping |
| | COURSE CODE | 23BD251 |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

## COURSE OBJECTIVES :

23BD251.CEO.1: To disseminate different types of prototyping tools and techniques.

23BD251.CEO.2: To impart the product development cycle through prototype projects.

23BD251.CEO.3: To inculcate hands-on skills for the development of prototyping as a team.

23BD251.CEO.4: To develop the ability to transmit multi-prototype information clearly and test the same by demonstration and presentation.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

23BD251.CO.1:Demonstrate the techniques, skills and modern engineering tools [L2].

23BD251.CO.2:Apply multi-skills to build/develop/prepare a prototype [L3].

23BD251.CO.3:Differentiate and operate various tools and machines [L3].

23BD251.CO.4:Illustrate the work carried out in a team [L4].

**PRACTICAL**

**Course Introduction:**

This course aims to work on a product/prototype development process based on multi-disciplinary aspects such as Mechanical, Civil, Computer, and Chemical modules. The main objective of this course is to learn different types of prototyping techniques, product development processes, etc. Students will learn to design, build and debug different engineering interdisciplinary products as a prototypes in team. Students will complete four modules in a rotational manner. Following is a brief introduction of individual modules such as,

1. Mechanical Prototyping (MP): Students will learn the different principles of Rapid Prototyping Techniques(RPT), model slicing, and 3D printing processes to manufacture a prototype through hands-on experience.

2. Civil Prototyping (CP): Students will learn basic skills of civil engineering and its product design. They perform tasks using concepts of Bamboo Architecture Design, and bamboo joinery by scaling down the structure prototype from selected materials.

3. Software Prototyping (SP): Students will get exposure to the software development life cycle (SDLC), and the use of the AEIOU Framework (Design Thinking) to decide the problem statement and its solution.

4. Chemical Prototyping (CHP): Students will learn and develop different chemical products in the form of chemical prototypes. They will prepare basic products such as sanitizer, bio-diesel, sanitizer, pen ink, soap, etc.

| MODULE: 1/4 | Mechanical Prototyping (MP) | 16 HOURS |
|---|---|---|

**PRACTICAL:**

| PRACTICAL NO. 01 | Introduction to Prototyping | 02 HOURS |
|---|---|---|

1. Introduction to prototyping, types of various prototypes, traditional prototyping vs. advanced rapid Prototyping. Types of rapid prototyping techniques.
2. Demand, applications, and growth of 3D printing in product development.
3. Case studies and need of prototypes in emerging fields like Bio - medicals, defense, manufacturing, aerospace, automobile industry, food industry, aviation,etc.

| PRACTICAL NO. 2 | Basics of CAD Modeling | 02 HOURS |
|---|---|---|

1. Introduction of 2D, 3D modelling using CAD software package.
2. Sketcher-workbench and its applications.
3. Part design workbench with generative sketching. Identify physical constraints of prototyping.

| PRACTICAL NO. 3 | 3D Modeling for Prototyping | 04 HOURS |
|---|---|---|

1. Introduction of 3D modeling and its interaction with prototype machines
2. Geometric modeling, types of geometric models, and solid models.
3. Case study on design based models.

| PRACTICAL NO. 04 | Pre-processing of 3D Model Slicing | 02 HOURS |
|---|---|---|

1. Pre-Processing the 3D Model in Cura software / 3D Slicer/ Eiger for slicing.
2. Selection of orientation of model, support generation, skin and wall thickness, speed and time for slicing and printing.

| PRACTICAL NO. 05 | Demonstration and 3D Printing | 04 HOURS |
|---|---|---|

1. Suitable filament material for 3D printing and selection for additive manufacturing types.
2. Demonstration of 3D printing machines, their pre-setting and filament material loading process.
3. Self-study of Bill of material (BOM).

| PRACTICAL NO. 06 | Project Presentation and Evaluation | 02 HOURS |
|---|---|---|

1. Final Presentation and demonstration of models
2. Demonstration in the video form and upload on YouTube as a digital portfolio.

## REFERENCE BOOK


1. Chua C K, Leong K F (2010) Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific, ISBN-13: 978-981277898.
2. Noorani R (2018), Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley Sons, ISBN: 978-0-471-73001-9.
3. Liou W L (2015), Rapid Prototyping and Engineering Applications: A toolbox for prototype development, CRC Press, ISBN: 978-0849334092.
4. Kamrani A K (2012), Rapid Prototyping: Theory & practice, Springer, ISBN: 978-0-387-23291-1.
5. Kenneth Cooper (2020), Rapid Prototyping Technology: Selection and Application, Marcel Dekker, Inc. New York, ISBN: 082470261.

| MODULE: 2/4 | Civil Prototyping (CP) | 16 HOURS |
|---|---|---|
| **PRACTICAL:** | | |
| **PRACTICAL NO. 01** | **Introduction to Sustainable Materials** | **04 HOURS** |
| Introduction of Prototyping. Uses of sustainable material and its properties. Sustainable Materials- Bamboo, Timber, Recycled material, etc. 3D models and animation of products. Case studies on bamboo structures. | | |
| **PRACTICAL NO. 02** | **Design of Bamboo Joinery** | **04 HOURS** |
| Hands-on practice on different types of joinery. Fish mouth joints, lash joints, lapping joints, etc. Develop new designs of joints. | | |
| **PRACTICAL NO. 03** | **Making of Structures/Product** | **04 HOURS** |
| Making of scaled/scale-down structures/products from the selected material. Products like chairs, stools, tensegrity structure, slit techniques, road barriers, etc. | | |
| **PRACTICAL NO. 04** | **Cost Analysis for the Structure/Product** | **02 HOURS** |
| Detailed cost estimation/analysis of the structure/product. | | |
| **PRACTICAL NO. 05** | **Final Video Presentation (Evaluation)** | **02 HOURS** |
| Final Presentation and demonstration of models. Demonstration in the video form and upload on YouTube as a digital portfolio. | | |

**REFERENCE BOOK**


1. Beer & Johnston (2018), Vector Mechanics for Engineers: statics and dynamics, 10th edition, McGraw Hill Education, ISBN: 978-0073398242.
2. Chris van Uffelen (2013), Bamboo Architecture & Design (Architecture & Materials), by ISBN: 978-3037681824.
3. Jules J.A. (2015), Designing and Building with Bamboo, Janssen Technical University of Eindhoven Eindhoven, The Netherlands, ISBN 978-8186247464.

| MODULE: 3/4 | Software Prototyping (SP) | 14 HOURS |
|---|---|---|
| **PRACTICAL:** | | |
| **PRACTICAL NO. 01** | **Introduction to Software Engineering** | **02 HOURS** |
| Concepts, Software development life cycle (SDLC). Students need to use AEIOU Framework (Design Thinking) to decide the problem statement. Students will work in groups of three on the AEIOU framework | | |
| **PRACTICAL NO. 02** | **Requirement Analysis** | **02 HOURS** |
| Find the requirement specification of a given problem statement and formulate the feasible solution. | | |
| **PRACTICAL NO. 03** | **Design UML Diagrams for given Problem Statement** | **02 HOURS** |
| Project Development Canvas and then design the following, using a lucid chart tool. Creation of use case diagram, design of an activity diagram, design of Sequence diagram. | | |
| **PRACTICAL NO. 04** | **Design Analysis** | **02 HOURS** |
| Create High Fidelity Prototype using proto.io | | |
| **PRACTICAL NO. 05** | **Prototype Implementation** | **04 HOURS** |
| Web site development using tools such as HTML, JSCRIPT, Proto.io, Invision etc. | | |
| **PRACTICAL NO. 06** | **Presentation** | **02 HOURS** |
| Each group will be given 10 min to present their work | | |

**REFERENCE BOOK**


1. Roger S, Pressman (2016), Software Engineering A practitioner's Approach, 7th Edition, ISBN: 9780073375977.
2. Jonathan Arnowitz, MichaleArent (2014), Effective prototyping for software Makers, ACM Digital Library, ISBN-13:978-0120885688
3. Chua, C. K., Leong, K. F. (2010), Rapid Prototyping: Principles and applications in manufacturing, New York: Wiley, ISBN: 978-9812778987.
4. Fab - Gershenfeld, N. (2018), The coming revolution on your desktop - from personal computer to personal fabrication, New York: Basic Books. ISBN:978-0465027453.
5. Noorani, R. (2016), Rapid prototyping: Principles and applications, NJ: Wiley.ISBN: 978-0-471-73001-9.
6. Pham D. T.,Dimov S. S. (2011), Rapid manufacturing: The technologies and applications of rapid prototyping and rapid tooling, New York: Springer. ISBN: 978-1447111825.

| MODULE: 4/4 | Chemical Prototyping | 14 HOURS |
|---|---|---|
| **PRACTICAL:** | | |
| **PRACTICAL NO. 01** | **Introduction to manufacturing process** | **02 HOURS** |
| Introduction to chemical prototype and manufacturing process. Selection of manufacturing product and method. | | |
| **PRACTICAL NO. 02** | **Basic material selection** | **04 HOURS** |
| Introduction of the method and material selection. Block diagram for the process. | | |
| **PRACTICAL NO. 03** | **Manufacturing of the Product** | **06 HOURS** |
| Used unit operation and raw material for manufacturing and performance of actual experimentation | | |
| **PRACTICAL NO. 04** | **Project presentation** | **02 HOURS** |

1. Final Presentation and demonstration of models.
2. Report submission (Final Assessment and Evaluation).

List of manufacturing products:

1. Preparation of Soap
2. Preparation of Sanitizer
3. Preparation of detergent powder
4. Preparation of bio-diesel
5. Preparation of talcum powder
6. Preparation of biscuits
7. Preparation of bread
8. Preparation pen ink
9. Preparation of food color
10. Preparation of herbal hair dye
11. Preparation of herbal juice
12. Preparation of Oxalic Acid from sugar cane
13. Preparation of urea-formaldehyde resin
14. Preparation of phenol formaldehyde resin, etc.

## REFERENCE BOOK


1. Richard A. Winter (2009), A Prototype Chemical Substances Information Network, Computer Corporation of America, Council on Environmental Quality (U.S.), Computer Corporation of America.
2. Pawel L. Urban, (2018), Prototyping Instruments for the Chemical Laboratory Using Inexpensive Electronic Modules, https://doi.org/10.1002/anie.201803878.
3. Coulson J.M, et al (1999), Chemical Engineering, Vol. 1 & 2, Butter worth Heinemann, 6th Edition, ISBN 9780080494227.
4. Foust A.S, Principles of Unit Operations (2007), John Wiley, ISBN 9780471268963.
5. Seader J.D & Henley E.J (2016), Separation Process Principles, John Wiley, 2nd Edition, ISBN 9780471586265.
6. McCabe W. L. and Smith J.C.(1993), Unit Operations in Chemical Engineering, 5th Edition, McGraw Hill Publications,ISBN 007448442.
7. Badger W. L and Banchero J.T. (2015), Introduction to Chemical Engineering, McGraw Hill Publications, ISBN 0070029954.
8. Austin G.T, Sherves (2016), Chemical Process Industries, 5th Edition, McGraw Hill, (ISBN: 9780070661677).

## ANNEXURE

Each module will have an average of seven laboratory sessions. The students will complete two modules before the mid-semester exam and another two modules after mid-semester exam, in a rotational manner. Marks of four modules at a time will be averaged in one semester and if a student secures passing marks (passing grade) after averaging; then the required credits of the course will be earned.

### A) Course Execution:

| **III Semester - Upto Mid-Semester Exam** | | | |
|---|---|---|---|
| **Module** | **School** | **Module** | **School** |
| 1)Mechanical Proto | Computer Engineering | 3)Computer Proto | ENTC/ETX |
| 2)Civil Proto | | 4)Chemical Proto | |

| **III Semester - After Mid-Semester Exam** | | | |
|---|---|---|---|
| **Module** | **School** | **Module** | **School** |
| 1)Mechanical Proto | ENTC/ETX | 3)Computer Proto | Computer Engineering |
| 2)Civil Proto | | 4)Chemical Proto | |

| **IV Semester - Upto Mid-Semester Exam** | | | |
|---|---|---|---|
| **Module** | **School** | **Module** | **School** |
| 1)Mechanical Proto | Civil and Chemical Engineering | 3)Computer Proto | Mechanical Engineering |
| 2)Civil Proto | | 4)Chemical Proto | |

| **IV Semester - After Mid-Semester Exam** | | | |
|---|---|---|---|
| **Module** | **School** | **Module** | **School** |
| 1)Mechanical Proto | Mechanical Engineering | 3)Computer Proto | Civil and Chemical Engineering |
| 2)Civil Proto | | 4)Chemical Proto | |

**B) Evaluation Structure:**

| **Prototyping Module** | | **Group Size** | **Demo / Presentation** (40 Marks) | | | **Continuous Activities** (35 Marks) | | **Total Marks** (75 Marks) |
|---|---|---|---|---|---|---|---|---|
| No. | Name | Student | Submission Mode | Report | PPT/ Video | Activity | Quiz | Total Activity |
| 1 | Mechanical | 5 | Report & Video/PPT | Yes | Yes | 02 | 01 | 05 |
| 2 | Civil | 5 | Report & Video | Yes | Yes | 02 | 01 | 05 |
| 3 | Computer | 5 | Presentation | Yes | Yes | 03 | 00 | 05 |
| 4 | Chemical | 5 | Report & Video/PPT | Yes | Yes | 02 | 01 | 05 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Project Implementation |
| | COURSE CODE | 2308292L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE:** Knowledge of engineering fundamentals.

**COURSE OBJECTIVES :**

2308292.CEO.1: To develop a sense of curiosity and critical thinking approach for implementing the solutions to the real world problems.

2308292.CEO.2: To disseminate the project implementation techniques / methodological approaches to propose solution to the real world problems.

2308292.CEO.3: To cognize the ethical principles, standard engineering practices in general and its importance in project implementation, documentation and ethical writing.

2308292.CEO.4: To develop a sense of responsibility while working in a team and practice professional ethics.

2308292.CEO.5: To disseminate the importance of Intellectual property rights, writing the research articles and publication.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2308292.CO.1: Demonstrate an ability to apply discipline specific modern project management tools, techniques and resources to solve the real world project problem [L3].

2308292.CO.2: Implement feasible solutions using scientific principles and considering the socio-economic, sustainability factors for solving real world problems [L3].

2308292.CO.3: Apply the knowledge of professional ethics and standard engineering practices for project implementation, testing and documentation [L3].

2308292.CO.4: Demonstrate an ability to adhere to the professional ethics and behave responsibly as an individual and in a team and present the concepts/ prototypes/ models during theproject demonstration [L3].

2308292.CO.5: Demonstrate an ability to prepare research article, Intellectual property rights [L3].

## COURSE ABSTRACT

Field project is an avenue to cater Societal and Industrial needs. Project implementation is one of the course where students will try to solve real time engineering problems. This course focuses on Selection and application of state or art technologies/ methods/engineering tools/software/analytical techniques for comparing and providing the feasible solution. Further it emphasizes on the importance of socio-economic and sustainability factors while implementing the final solution. Through this course students learn to implement the engineering fundamental concepts, get practical experience, get the chance to showcase skills, learn about team work, communication skills and responsibilities, professional behaviour. It also imparts knowledge of standard engineering practices and Intellectual Property Rights.

**Guidelines**

Preferably project team students of Sem III would be continued in this semester IV. Every project team should consist of minimum 03 and maximum of 04 students. The team members may be from different programs to support the interdisciplinary and / or multidisciplinary functioning.

1. Team members should deliberate upon different methodical approaches and finalize the appropriate method.
2. Students project team should explore different Engineering tools/techniques for providing the problem specific solution.
3. Justify the selected method/Engineering tools/analytical techniques identified based on the feasibility, affordability and ease of use.
4. To implement the solution ,it is imperative to take inputs/suggestions from various stake holders.
5. Solution must be critically analyzed from various engineering and social aspects.
6. Completed solution must be pilot tested from the target user/stake holders.
7. Students need to protect their innovation,proof of concept through IPR.
8. While working in a team, individual student should contribute and communicate effectively to maintain team balance.
9. Learn and apply standard engineering practices and professional ethics.
10. Adherence to the principles of ethics, code of conduct and standard engineering practices is required.

**TIMELINE**

The THREE member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Presentation of Project Review -1- Phase-I : Implementation / development of the project. 3 Weeks (1st -3rd week)
2. Presentation of Project Review -2 - Phase -II : Project implementation and testing.: 3 weeks (4rd- 6th week)
3. IPR Activity on earlier selected project problem : 2 Weeks (7th-8th week)
4. Preparation of Project Progress Report (week 9th and 10th)
5. Project Documentation ( 11th week) (Assessment by project Guide)
6. Submission of the final project copy to the project guide. ( 12th week)
7. Evaluation by external examiner ( End Semester by 13th, 14th week)

**Project Demonstration (50 Marks)**

1. **Review 1 (Project Implementation) (05 marks)**
   - Use appropriate procedures, modern tools and techniques to conduct experiments and collect data, represent in tabular/ graphical form and draw valid conclusions.
   - Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem and Verify the credibility of results.
2. **Review 2 (Project Demonstration) (10 marks)**
   - Demonstrate proficiency in using discipline specific modern tools/ techniques to solve the project problem.
   - Demonstrate an ability to describe engineering roles in a broader context, pertaining to the environment, safety, public welfare.
3. **Project Activities (05 Marks)**
   - Demonstrate an ability to prepare and publish research article.
   - Demonstrate an ability to write a Patent Draft, file IPR.
4. **Project Documentation (10 marks)**
   - Produce clear, well-constructed, and well-supported written engineering documents, project cost sheet and plagiarism report.
5. **Final project demonstration & Project team presentation (20 marks)**
   - Demonstrate effective communication,Implement the norms of standard professional practices, Present results as a team showing the responsible behaviour.

**TEXT BOOKS**


1. Schmidt, T. (2009). Strategic Project Management Made Simple. 2nd Edition, Wiley Pub, India.ISBN 978-1-119-71817-8
2. Challender, J. (2022). Professional Ethics in Construction and Engineering", Wiley .ISBN-13: 978-1-119-83210-2
3. Rogerson, S. (2003). Computer Ethics and Professional Responsibility. 1st Edition Wiley Blackwell Publication.ISBN-13: 978-1855548459
4. Nagarazan, R.S. (2022). A Textbook on Professional Ethics and Human Values. New Age Publication, ISBN-13: 978-81-224-2301-3
5. Hering, L. and Hering H. (2005). How to write Technical Reports. Springer ISBN : 978-3-540-69929-3
6. Tewari, R. and Bhardwaj, M. (2021).Intellectual Property A Primer for Academia. Publication Bureau, Panjab University Chandigarh ISBN: 81-85322-92-9

## REFERENCE BOOKS


1. Zwikael, O. and Smyrk, J. (2019). Project Management A Benefit Realization Approach. Springer Publication, ISBN-13: 978- 0134877693
2. Handley, W. (1977). Industrial Safety Handbook. 2nd Revised edition ,McGraw-Hill Companies;, ISBN-13: 978-0070844810
3. Mislick, G. and Mussbaum, D. (2015) Cost Estimation: Methods and Tools. Wiley, ISBN-13: 978-1-118-53613-1
4. Chilcutt, A. and Adam, J. (2019). Engineered to Speak: Helping You to Create and Deliver Engaging Technical Presentations. Wiley, ISBN-13: 978-1-119-47496-8


## E-RESOURCES

1. University of California, free online course: https://www.classcentral.com/course/project-planning-1-12208
2. International Journal of Project Management : https://www.sciencedirect.com/journal/international-journal-of-project-management
3. Procedia- Social and Behavioral Sciences Open access journal: https://www.sciencedirect.com/journal/procedia-social-and-behavioral-sciences
4. Free software tool for project Management : https://onlinepmcourses.com/project-management-tools/free-project-management-resources/
5. Research Article:https://doi.org/10.1016/j.sbspro.2012.12.210
6. Research Article: https://doi.org/10.1016/j.tsc.2024.101477
7. Research Article: https://doi.org/10.1016/j.ijproman.2024.102584

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Internship (Life and Soft Skills) |
| | COURSE CODE | 2308296L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | NIL | 75 | 75 |

**PRE-REQUISITE :** Knowledge about the communication skills

**COURSE OBJECTIVES :**

2308296L.CEO.1: To enhance technical skills and self-directed learning.

2308296L.CEO.2: To develop adaptability and resilience in a multicultural or professional environment.

2308296L.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2308296L.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2308296L.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2308296L.CO.1: Utilize online learning platforms effectively to acquire technical skills and engage in lifelong learning [L3].

2308296L.CO.2: Apply professional behavioral practices, including teamwork, time management, and ethical decision-making, in diverse settings [L3].

2308296L.CO.3: Evaluate personal growth and adaptability gained through experiential learning and real-life experiences [L4].

2308296L.CO.4: Evaluate personal growth and adaptability gained through experiential learning and real-life experiences [L4].

2308296L.CO.5: Formulate well-defined problem statements by critically examining real-world challenges and exploring innovative approaches [L4].

2308296L.CO.6: Demonstrate effective communication skills by preparing and delivering professional presentations and writing clear, concise reports [L5].

**INTRODUCTION:**

This internship is designed to equip second-year entrants B.Tech. students with essential skills for personal and professional growth. The program focuses on cultivating professionalism and life skills, enabling students to enhance their technical and soft skills in today's competitive landscape. Through this experience, students will develop a comprehensive skill set, including emotional intelligence, effective communication, teamwork, and sportsmanship. Additionally, the course encourages active participation in co-curricular and extracurricular activities, fostering resilience, adaptability, and a collaborative spirit. By completing this internship, students will establish a solid foundation for academic success and career readiness.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Life and Soft Skills is designed for students entering the second year of the B.Tech. program, to be undertaken during the summer break after Semester II. This program aims to provide opportunities for skill enhancement through life skills development, technical skills training, or industrial exposure. The internship focuses on helping students identify and engage with relevant learning platforms, small-scale industries, or training opportunities to build competencies essential for personal and professional growth. The program emphasizes cultivating life skills, such as effective communication, teamwork, emotional intelligence, and adaptability, alongside fostering technical expertise.

**Structure**

- **Duration:** : 3 to 4 weeks (minimum of 100 hours).
- **Timeframe:** Conducted during June-July of each academic year.
- **Nature of Internship:**

1. Life skills development courses.
2. Technical skills training programs.
3. Industrial training with companies or small-scale industries.

- **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.
- **Mentorship:** Each first-year student will be assigned their first-year mentor as their internship guide. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development.

**Student Development Focus :**

Before selecting an internship option, students are required to identify specific areas of self-development they wish to enhance. This may include life skills (e.g., communication, leadership, emotional intelligence), technical competencies, or professional abilities.

Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

---

**1. Continuous Assessment (CA): Biweekly Progress Reports and interaction with faculty mentor (40%):**

Students must submit at least two progress reports during the internship/training period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them
- Reports will be evaluated by the assigned first-year faculty mentor based on content quality, reflection, and consistency.

**2. Detailed Project Report with Learning Outcomes (30%)**

Upon completion of the internship, students are required to submit a comprehensive minimum of 20 to 25 pages' internship/project report. The report must include:

1. Overview of training activities
2. Skills and knowledge acquired (technical/soft/life)
3. Specific challenges addressed
4. Personal and professional growth reflections
5. Clearly stated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certificate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Indian Constitution |
| | COURSE CODE | 2301281A |
| | COURSE CREDITS | (Audit Course) |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | NIL | NIL | NIL | NIL | NIL | NIL | NIL |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2301281A.CEO.1: To realise the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.
2301281A.CEO.2: To identify the importance of fundamental rights as well as fundamental duties.
2301281A.CEO.3: To understand the functioning of Union, State and Local Governments in Indian federal system
2301281A.CEO.4: To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure

## COURSE OUTCOMES:

The students after completion of the course will be able to,

2301281A.CO.1: Explain the significance of Indian Constitution as the fundamental law of the land [L2].
2301281A.CO.2: Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building [L2].
2301281A.CO.3: Analyze the Indian political system, the powers and functions of the Union, State and Local Governments in detail [L3].
2301281A.CO.4: Explain Electoral Process, Emergency provisions and Amendment procedure [L2].

## COURSE ABSTRACT

Indian constitution is an audit course designed for the all FY. BTech students. Indian constitution is a great source of human values promoting through its legislative, executive and judiciary institutions. The key values that are learnt from constitution are justice, liberty, equality and fraternity. Constitution also teaches us to be impartial, non-partisan and tolerant in our attitude and public interactions. Liberty of thought, expression, belief or faith is necessary for all round development of an individual which the constitution teach and protects. It also inculcates the value of fraternity that promotes the spirit of common brotherhood among all citizens.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Indian Constitution** | **3 HOURS** |

Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India, Salient features and characteristics of the Constitution of India, Scheme of the fundamental rights, The scheme of the Fundamental Duties and its legal status, The Directive Principles of State Policy – Its importance and implementation.

| | | |
|---|---|---|
| **UNIT 2** | **Federal Structure and Amendment** | **5 HOURS** |

Federal structure and distribution of legislative and financial powers, between the Union and the States, Parliamentary Form of Government in India – The constitution powers and status of the President of India, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India.

| | | |
|---|---|---|
| **UNIT 3** | **Emergency Provisions** | **2 HOURS** |

Emergency Provisions: National Emergency, President Rule, Financial Emergency.

| | | |
|---|---|---|
| **UNIT 4** | **Constitutional Schemes** | **5 HOURS** |

Local Self Government – Constitutional Scheme in India, 13. Scheme of the Fundamental Right to Equality, Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and Personal Liberty under Article 21.

## TEXT BOOKS


1. Basu, D. D., Manohar, V. R., Banerjee, B. P., & Khan, S. A. (2015). Introduction to the Constitution of India (pp. 87-9). Gurgaon: LexisNexis..
2. Austin, G. (1966). The Constitution of India: Cornerstone of a Nation.


## REFERENCE BOOKS


1. Bakshi, P. M., & Kashyap, S. C. (1982). The constitution of India. Universal Law Publishing.
2. Pylee, M. V. (2003). Constitutional government in India. S. Chand Publishing.


## E-RESOURCES (NPTEL Courses)

1. Constitutional Studies - Course (nptel.ac.in)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (REVISION ) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F | : | |
| THIRD YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| SEMESTER: V (INFORMATION TECHNOLOGY) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT/TUT | | TOTAL | |
| | | | L | P | T | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304311T | Operating Systems | 3 | - | - | 20 | 30 | 50 | - | - | 100 | 3 |
| | 2304311L | Operating Systems Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2304312T | Computer Networks | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304312L | Computer Networks Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PEC | 2304321T | Exploratory Data Analytics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2304322T | Artificial Intelligence Machine Learning | | | | | | | | | | |
| | 2304323T | Cloud Computing Foundation | | | | | | | | | | |
| | 2304324T | Cryptography and Information Security | | | | | | | | | | |
| | 2304321L | Exploratory Data Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2304322L | Artificial Intelligence Machine Learning Lab | | | | | | | | | | |
| | 2304323L | Cloud Computing Foundation Lab | | | | | | | | | | |
| | 2304324L | Cryptography and Information Security Lab | | | | | | | | | | |
| VSEC | 2304361L | Linux Administration-I | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2304362L | Web Technology | | | | | | | | | | |
| | 2304363L | Mobile Application Development | | | | | | | | | | |
| | 2304364L | UI/UX Design | | | | | | | | | | |
| MDM | *MDM List | Multi Disciplinary Minor Course-II | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | *MDM List | Multi Disciplinary Minor Course-II Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ELC PRJ | 2304391L | Major Project - I | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2304396L | Summer Internship (Technical) | - | - | - | - | - | - | - | 75 | 75 | 2 |
| TOTAL | | | 11 | 16 | - | | | | | | 800 | 21 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (REVISION ) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F | : | |
| THIRD YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| SEMESTER: VI (INFORMATION TECHNOLOGY) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | L | P | T | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2304313T | Software Engineering | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2304313L | Software Engineering Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| PCC | 2304314T | Design & Analysis of Algorithms | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2304314L | Design & Analysis of Algorithms Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| PEC | 2304326T | Predictive Analytics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2304327T | Deep Learning | | | | | | | | | | | |
| | 2304328T | Cloud Native Application Development | | | | | | | | | | | |
| | 2304329T | Cyber Security & Forensics | | | | | | | | | | | |
| | 2304326L | Predictive Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| | 2304327L | Deep Learning Lab | | | | | | | | | | | |
| | 2304328L | Cloud Native Application Development Lab | | | | | | | | | | | |
| | 2304329L | Cyber Security & Forensics Lab | | | | | | | | | | | |
| VSEC | 2304366L | Linux Administration-II | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| | 2304367L | Cloud Services | | | | | | | | | | | |
| | 2304368L | Practioner's Approach to AI | | | | | | | | | | | |
| | 2304369L | Web and Desktop Application Development | | | | | | | | | | | |
| MDM | *MDM List | Multi Disciplinary Minor Course-III | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | *MDM List | Multi Disciplinary Minor Course-III Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| HSSM AEC | 2301371L | Employability and Career Development | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| ELC PRJ | 2304392L | Major Project - II | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| TOTAL | | | 11 | 20 | - | | | | | | 800 | 21 | |

*Four Credit Internship needs to be completed after Completion of the Third Year

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | OPERATING SYSTEMS |
| | COURSE CODE | 2304311T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Data Structures

**COURSE OBJECTIVES :**

2304311T.CEO.1: To impart knowledge of key operating system concepts and its services
2304311T.CEO.2: To provide comprehensive understanding of the concepts related to process, Inter process communication (IPC), scheduling and deadlock management
2304311T.CEO.3: To discuss memory management schemes in operating system
2304311T.CEO.4: To familiarize file management and protection aspects of Operating system

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304311T.CO.1: Identify the role of OS in the management of system resources [L3]
2304311T.CO.2: Build concurrent solutions using synchronization mechanisms and multi-threading [L3]
2304311T.CO.3: Analyze advanced deadlock prevention and avoidance techniques [L4] 2304311T.CO.4: Examine memory allocation policies and memory protection mechanisms [L4] 2304311T.CO.5: Inspect security measures across file systems in operating systems [L3]

**COURSE ABSTRACT:**

Operating systems play a crucial role in the field of computer engineering. It acts as a bridge between hardware and software, managing the resources of a computer system such as memory, CPU, storage, and input/output devices. Operating systems enable multitasking, allowing multiple programs to run concurrently and efficiently share system resources. Additionally, operating systems provide essential services such as file management, security mechanisms, device drivers, and network communication protocols, ensuring the smooth and secure operation of computer systems. Overall, operating systems are foundational components in computer engineering, facilitating software development, resource management, multitasking, and system stability.

**THEORY COURSE CONTENT**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Operating System** | **5 HOURS** |

**App/System/Case study:** Open Source Operating System-Linux

**Contents:**

Operating System Overview, Functions, Types of OS- Batch, Timesharing, Multiprogramming, Multitasking ,Distributed,Network and Realtime (RTOS), OS Structure-monolithic,micro,hybrid, System Calls,System Boot,Unix Architecture

**Self -Study:** Virtual Machines, Dual Mode Operation.

**Further Reading:** Use of OS in various computing environments

| | | |
|---|---|---|
| **UNIT 2** | **Process Management** | **8 HOURS** |

**App/System/Case study:** Process Management in Online Transaction Processing Systems

**Contents:** Process Concept, Process Scheduling-Scheduling Queues, Schedulers, Context Switch, Operations on processes, Inter process Communication-Shared Memory, Message Passing Systems, Pipes, Inodes, Process State Transition in Unix (9 states)

**Self-Study:** Communication in Client-Server Systems

**Further Reading:** Operating System Debugging

| | | |
|---|---|---|
| **UNIT 3** | **Multithread Programming and CPU Scheduling** | **8 HOURS** |

**App/System/Case study:** Multithreading in Web Servers

**Contents:** Thread Overview, Multicore Programming, Multithreading Models, Thread Libraries Threading issues. Basic Concepts of CPU scheduling, Scheduling criteria, Scheduling Algorithms-FCFS, SJF, Priority and Round Robin

**Self-study:** Thread creation in Linux

**Further Reading:** Scheduling Algorithms in RTOS

| | | |
|---|---|---|
| **UNIT 4** | **Process Synchronization and Deadlock** | **8 HOURS** |

**App/System/Case study:** Distributed Deadlocks

**Contents:** Process Synchronization overview, The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic problems of synchronization, Deadlock, Methods for Handling Deadlocks,Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery

**Self- Study:** Synchronization in graphics and multimedia processing

**Further Reading:** Techniques for testing and debugging concurrent programs

| UNIT 5 | Memory Management | 8 HOURS |
|---|---|---|

**App/System/Case study:** ARM architecture

**Contents:** Main memory-Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of page table, Virtual Memory-Demand Paging, Page Replacement Policies: FIFO, LRU, Optimal, Allocation of Frames, Thrashing

**Self- Study:** Linux memory management schemes

**Further Reading:** Memory Management in xv6

| UNIT 6 | File Management and System Protection | 8 HOURS |
|---|---|---|

**App/System/Case study:** Linux File System.

**Contents:** File-System structure, File-System Implementation, Directory Implementation, Al- location Methods, Internal Representation of files in UNIX through Inodes, System Protection:Goals,Principles,Domain,Access Matrix,Access Control,Revocation of Access Rights

**Self- Study:** Domain in UNIX and MULTICS

**Further Reading:** WAFL File System

**TEXT BOOKS**


1. Silberschatz, A., Galvin, P. B., Gagne, G. (2018). Operating system concepts. Wiley. ISBN : 1119439256
2. Bach, M. J. (1986). The design of the UNIX operating system. Prentice/Hall. ISBN : 0132017571


**REFERENCE BOOKS**


1. Stallings, W. (2018). Operating systems : internals and design principles. Pearson. ISBN-13: 9780137516742
2. Deitel, H. M., Deitel, P. J., Choffnes, D. R. (2004). Operating Systems. Prentice Hall. ISBN- 13:978-0131828278


**E-RESOURCES**


1. Ritchie, D. M., Thompson, K. (1983). The UNIX time-sharing system. Communications of the ACM, 26(1), 84–89. https://doi.org/10.1145/357980.358014

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | OPERATING SYSTEMS LAB |
| | **COURSE CODE** | 2304311L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Requires knowledge of Data Structures

**~~COURSE OBJECTIVES :~~**

2304311L.CEO.1: To explain the basic concepts of shell programming.

2304311L.CEO.2: To make familiar the programming concepts for interprocess communication and memory management.

2304311L.CEO.3: To emphasize on implementation aspect of CPU Scheduling Algorithms.

2304311L.CEO.4: To get acquainted with different problems of synchronization.

2304311L.CEO.5: To describe various methods of handling deadlocks in operating systems.

**~~COURSE OUTCOMES :~~**

After successful completion of the course, students will be able to,

2304311L.CO.1: Apply shell scripting and system calls to create efficient process-based solutions, including inter process communication (IPC) techniques[L3].

2304311L.CO.2: Demonstrate the ability to manage system resources through scheduling techniques and analyze their impact on overall system performance. [L3].

2304311L.CO.3: Analyze and compare page replacement algorithms to ensure effective virtual memory management[L4].

2304311L.CO.4: Build secure and concurrent systems using synchronization mechanisms, multi-threading techniques, and controlled file system access[L5].

**COURSE ABSTRACT:**

The operating system laboratory holds significant importance in computer engineering education and research. Laboratory exercises reinforce theoretical concepts learned in operating system courses, such as process management, memory management, file systems, and concurrency control.Comparison of the performances of various scheduling algorithms, memory allocation strategies, and file system designs is explored . Thus operating system laboratory is a crucial component of computer engineering education, offering practical learning opportunities, skill development, and preparation for professional roles in the IT industry. It bridges the gap between theory and practice, equipping students with the expertise needed to tackle complex system challenges and innovate in the field of operating systems and software development.

| PRACTICALS Perform following experiments using Open source tools | | |
|---|---|---|
| **PRACTICAL NO.01** | **Write shell script to display disk space usage of the ftle system, including the total space, used space, available space, and usage percentage** | **6 HOURS** |
| Further practice: 1. Write a shell script that implements various file and directory related commands.<br>2. Write a shell script that checks and sets file system permissions for files and directories based on specified criteria, such as ownership and read/write/execute permissions. | | |
| **PRACTICAL NO.02** | **Develop a program to demonstrate process creation, termination, and communication using PIPE as an IPC (Interprocess Communication) mechanism.** | **4 HOURS** |
| Further practice: 1. Implement Interprocess Communication using Shared Memory.<br>2. Implement Interprocess Communication using Message Passing | | |
| **PRACTICAL NO.03** | **Implement a simple process scheduler using schedul- ing algorithms such as FCFS (First-Come, First- Served), SJF (Shortest Job First), and RR (Round Robin).** | **4 HOURS** |
| Further practice: Implement a simple process scheduler using non preemptive scheduling algorithms like SJF (Shortest Job First) and Priority scheduling algorithm.<br>Implement a simple process scheduler using preemptive Priority scheduling algorithm. | | |
| **PRACTICAL NO.04** | **Implement synchronization mechanisms such as semaphores, mutexes, and condition variables to solve synchronization problems for any suitable mul- tithreaded application.** | **4 HOURS** |
| Further practice: Develop a thread pool manager that maintains a pool of worker threads for executing tasks concurrently. Use semaphores or mutexes to manage thread creation, task assignment, and synchronization between the main thread and worker threads. | | |
| **PRACTICAL NO.05** | **In a real computer system, neither the resources available nor the demands of processes for resources are consistent over long periods (months). Resources break or are replaced, new processes come and go, and new resources are bought and added to the sys- tem. If deadlock is controlled by the banker's algo- rithm, which of the following changes can be made safely (without introducing the possibility of dead- lock), and under what circumstances? a. Increase Available (new resources added). b. Decrease Avail- able (resource permanently removed from system).** | **4 HOURS** |
| Further practice: Design and implement a deadlock prevention scheme that imposes resource ordering to ensure that the system never enters a deadlock state. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.06** | **Implement a virtual memory system with features like demand paging, page replacement algorithms (e.g., FIFO, LRU,Optimal), and handling page faults.** | **2 HOURS** |
| Further practice: Implement best fit ,worst fit and worst fit algorithms for memory allocation. | | |
| **PRACTICAL NO.07** | **Design and implement a simple ftle system with ba- sic operations like ftle creation, deletion, reading, and writing using data structures like inodes and ftle al- location tables.** | **6 HOURS** |
| Further practice: Implement Role-Based Access Control (RBAC) concepts in operating system | | |

**TEXT BOOKS**


1. Nemeth, E., Snyder, G., Hein, T. R., Whaley, B., Mackin, D. (2017). UNIX and Linux System Administration Handbook. Addison-Wesley Professional. ISBN-13 978-0134277554
2. Das, S. (2017). Unix Concepts And Applications.Mcgraw-Hill. ISBN 978-0070635463
3. Williams, A. (2019). C++ Concurrency in Action. Simon and Schuster.ISBN : 9781638356356
4. Stevens, W., Rago, S. (2013). Advanced Programming in the UNIX Environment. Pearson Education. Limited.


**REFERENCE BOOKS**


1. Shotts, W. E. (2019). The Linux Command Line, 2nd Edition: A Complete Introduction. No Starch.
2. Robbins, K. A., Robbins, S. (2015). UNIX systems programming : communication, concurrency, and threads. Prentice Hall. ISBN: 978-0134424071


**E-RESOURCES**


1. Ritchie, D. M., Thompson, K. (1983). The UNIX time-sharing system. Communications of the ACM, 26(1), 84–89. https://doi.org/10.1145/357980.358014

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | COMPUTER NETWORKS |
| | COURSE CODE | 2304312T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Data Structure, Discrete Structures and Graph Theory

**COURSE OBJECTIVES :**

2304312T.CEO.1: To build understanding of fundamental concepts of data communication and networking.

2304312T.CEO.2: To differentiate between network types typologies.

2304312T.CEO.3: To explore routing algorithms applications in various scenarios.

2304312T.CEO.4: To classify connection oriented and connection-less services.

2304312T.CEO.5: To explore current trends in networking technologies

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304312T.CO.1: Utilize signals and communications types with respect to network infrastructure. [L3]

2304312T.CO.2: Build different types of network topologies and protocols. [L3]

2304312T.CO.3: Evaluate routing protocols for different real time systems.[L5]

2304312T.CO.4: Analyze connection oriented and connectionless services.[L4]

2304312T.CO.5: Demonstrate different application/systems related to networking.[L3]

**COURSE ABSTRACT:**

A computer network is a set of computers connected together for the purpose of sharing resources. The most common resource shared today is connection to the Internet. Other shared resources can include a printer or a file server.

This course deals with fundamentals of computer network. It deals with various network models, types and OSI layers. This course provides uses of computer network, role of seven OSI layers for wire oriented and wireless communication.

At the end of the course, the students will be able to build an understanding of the fundamental concepts of computer computer networks, networking concepts, network standards protocols, fundamental network security etc.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Physical Layer** | **09 HOURS** |

**Applications/Case Study:** E-Mail System, Digital Speedometer, Multiuser Network Games **Contents:** Data Communications, Networks, Network Types: LAN,MAN, WAN, Wireless mesh net- work, Hybrid wireless networks Protocol Layering, The OSI Model, TCP/IP Protocol Suite, Data and Signals, Periodic analog signals, Digital Signals, Transmission Impairments, Data rate limits, Perfor- mance, Line Coding , Line Coding Schemes : Unipolar, Polar, Bipolar

**Self Study:** Standards And Administration

**Further Readings:** Transmission Modes.

| | | |
|---|---|---|
| **UNIT 2** | **Data Link Layer** | **09 HOURS** |

**Applications/Case Study:** WinRAR, WinZip

**Contents:**Introduction: Nodes and Links, Services, Two categories of links, Two sublayers , Link Layer addressing: Three types of addresses, Address Resolution Protocol(ARP), Error detection and correc- tion: Types of errors, redundancy, Detection Vs Correction, Coding, Block Coding: Hamming codes ,Cyclic Redundancy Check, Data Link Control and Services: Framing, Flow Control, Connectionless and Connection-Oriented, Data Link Layer Protocols : Simplest Protocol, Stop and Wait Protocol , Piggybacking , Stop-and-Wait ARQ ,Sliding Window Protocols: GO-Back-N ARQ, Selective-Repeat ARQ, Random Access: CSMA,CSMA/CD,CSMA/CA, Media access protocol for Wireless LAN

**Self Study:** Standard Ethernet

**Further Readings:** Wi-Max(IEEE Project 802.16).

| UNIT 3 | Network Layer | 09 HOURS |
|---|---|---|

**Applications/Case Study:** Team viewer, Windows Remote Desktop Connection

**Contents:** Introduction, Network Layer Services: Packetizing, Routing and Forwarding, Other Ser- vices, Packet Switching: Datagram Approach: Connectionless Service, Virtual-Circuit Approach: Connection-Oriented Service, Network-layer Performance: Delay, Throughput, Packet loss, IPv4 Ad- dresses: Address Space, Classful addressing, Classless Addressing, Dynamic Host Configuration Pro- tocol(DHCP), Network Address Translation(NAT), Internet Protocol(IP) , Internet Control Message Protocol(ICMPv4), Routing Algorithms: Distance-Vector Routing, Link-State Routing, Path-Vector Routing, Wireless routing protocol, Ad-hoc on demand Distance vector RP,

**Self Study:** Multicast Routing(tree based multicasting and Zone based multicasting)

**Further Readings:**Internet Group Message Protocol(IGMP).

| UNIT 4 | Transport Layer | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Microsoft Team, Cisco Webex, Google Hangout

**Contents:** Introduction: Transport Layer Services, Connectionless and Connection-Oriented Proto- cols, Transport-Layer Protocols: Services, Port Numbers, User Datagram Protocol(UDP): Datagram, Services, Applications, Transmission Control Protocol(TCP): Services, Features, Segment, Connection, Applications, Socket Programming, Ad-hoc TCP

**Self Study:** Application Controlled Transport Protocol (ACTP)

**Further Readings:**Real Time Transport Protocol (RTP)

| UNIT 5 | Application Layer | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Moodle Server, FileZilla, IP messenger, WhatsApp

**Contents:** Introduction: Providing Services, Application-Layer Paradigms, Domain Name System (DNS), Hypertext Transfer Protocol (HTTP), Simple Mail Transfer Protocol (SMTP), File Transfer Protocol (FTP).

**Self Study:** Simple Network Management Protocol (SNMP)

**Further Readings:** TerminaL Network(TELNET),Secure Shell(SSH)

| UNIT 6 | Networking Trends | 06 HOURS |
|---|---|---|

**Applications/Case Study:** VOIP, IoT

**Contents:** Introduction, Software Defined Networking(SDN): Concept, Architecture, Communication, Application, Network Security: Policy - Integrity , Confidentiality, Availability , Privacy, Overview Data Centric Networks, Secure routing in Ad-Hoc network: Requirements and Security aware Ad Hoc Routing protocol

**Self Study:** SD-WAN

**Further Readings:** Platform for Privacy Preferences(P3P).

**TEXT BOOKS**


1. Behrouz A. Forouzan, (2022) ”Data Communications and Networking”, 6th edition, Tata McGraw-Hill Publications, 2013
2. Doulas E. Comer, (2016) ”Computer Networks and Internets, 6th edition, Pearson Education Limited, ISBN 978-1292061177
3. C. Siva Ram Murthy, (2017) ” Ad-HoC Wireless Networks”, Pearson Publication, 26th impression,


**REFERENCE BOOKS**


1. . Andrew S. Tanenbaum, David J. Wetherall, (2022) ”Computer Networks”, 5thedition, Pearson Education India, ISBN 978-9332518742.
2. Larry L. Peterson Bruce S. Davie, (2011) “Computer Networks”, 4th edition, Morgan Kaufmann Publisher, ISBN 978-0-12-370548-8
3. William Stallings, (2020) ”Data and Computer Communications”, 9thedition, Pearson Education India, 2013, ISBN 978-9332518865
4. 4. Behrouz A. Forouzan, (2013) ”Data Communications and Networking”,5th edition, Tata McGraw-Hill Publications, ISBN 978-0-07-296775-3


**E-RESOURCES**

1. https://nptel.ac.in/courses/106106091

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | COMPUTER NETWORKS LAB |
| | **COURSE CODE** | 2304312L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Data Structure, Discrete Structures and Graph Theory

**COURSE OBJECTIVES :**

2304312L.CEO.1: To build understanding of fundamental concepts of data communication and networking.

2304312L.CEO.2: To differentiate between network types typologies.

2304312L.CEO.3: To explore routing algorithms applications in various scenarios.

2304312L.CEO.4: To classify connection oriented and connection-less services.

2304312L.CEO.5: To explore current trends in networking technologies

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304312L.CO.1: Make use of modern simulation tools to implement scenarios. [L3]

2304312L.CO.2: Evaluate routing protocols for different real time systems.[L5]

2304312L.CO.3: Analyze connection oriented and connectionless services.[L4]

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **.** | **2 HOURS** |
| Setup a wired LAN using Layer 2 Switch and then IP switch of minimum four computers. It includes preparation of cable, testing of cable using line tester, configuration of machine using IP addresses, testing using PING utility and demonstrate the PING packets captured traces using Wireshark Packet Analyzer Tool. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Using Cisco Packet tracer design and test the a. Different network topologies b. Subnet | | |
| **PRACTICAL NO.03** | **.** | **4 HOURS** |
| Write a program to detect and correct single bit error using a. Parity Check b. Cyclic Redundancy Check and c. Hamming code | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Write a program to implement sliding window mechanism using a. Stop and Wait ARQ b. Go Back N ARQ c. Selective Repeat ARQ | | |
| **PRACTICAL NO.05** | | **4 HOURS** |
| Write a program to implement subnet calculator. | | |
| **PRACTICAL NO.06** | | **2 HOURS** |
| Write a program to implement Distance Vector Routing / Link State Routing. | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Write a program to implement simple communication between Client-Server using sockets utility (TCP and UDP) and demonstrate the packets captured traces using Wireshark Packet Analyzer Tool. | | |
| **PRACTICAL NO.08** | **Mini Project** | **06 HOURS** |
| Mini Project Guide Lines Maximum 3 students allowed in each group. Each group will work on design and Implementation. Students should submit the report in soft copy and hard copy. | | |

**TEXT BOOKS**


1. Behrouz A. Forouzan, (2022) ”Data Communications and Networking”, 6th edition, Tata McGraw-Hill Publications, 2013
2. Doulas E. Comer, (2016) ”Computer Networks and Internets, 6th edition, Pearson Education Limited, ISBN 978-1292061177
3. C. Siva Ram Murthy, (2017) ” Ad-HoC Wireless Networks”, Pearson Publication, 26th impression,


**REFERENCE BOOKS**


1. . Andrew S. Tanenbaum, David J. Wetherall, (2022) ”Computer Networks”, 5thedition, Pearson Education India, ISBN 978-9332518742.
2. Larry L. Peterson Bruce S. Davie, (2011) “Computer Networks”, 4th edition, Morgan Kaufmann Publisher, ISBN 978-0-12-370548-8
3. William Stallings, (2020) ”Data and Computer Communications”, 9thedition, Pearson Education India, 2013, ISBN 978-9332518865
4. 4. Behrouz A. Forouzan, (2013) ”Data Communications and Networking”,5th edition, Tata McGraw-Hill Publications, ISBN 978-0-07-296775-3


**E-RESOURCES**

1. https://nptel.ac.in/courses/106106091

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | EXPLORATORY DATA ANALYTICS |
| | **COURSE CODE** | 2304321T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Essential of Data Science, Applied Mathematics

**COURSE OBJECTIVES :**

2304321T.CEO.1: To understand the data warehouse architecture.
2304321T.CEO.2: To apply the various operations on OLAP cubes.
2304321T.CEO.3: To outline the various preprocessing operations on data warehouses.
2304321T.CEO.4: To explain the different hypothetical Tests.
2304321T.CEO.5: To apply the different association algorithms
2304321T.CEO.6: To implement decision tree based classification techniques

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304321T.CO.1: Select the efficient data warehouse architecture for the given case study.[L3]
2304321T.CO.2: Develop a data mart using different modeling techniques for given applications and present it in a group.[L3]
2304321T.CO.3: Analyze the prediction by hypothesis testing using data analysis tools.[L4]
2304321T.CO.4: Construct a model for providing predictions on given datasets by identifying trends, detecting outliers on real-time application using available tools and technology.[L4]

**COURSE ABSTRACT:**

Exploratory Data Analytics is the first course under Data Science track. Exploratory Data Analytics is a foundational course designed to equip students with the essential skills and knowledge necessary to extractactionable insights from data. This course provides a comprehensive overview of various techniques andmethodologies utilized in descriptive analytics, focusing on data preprocessing, analysis, and interpreta-tion. Students will learn how to leverage data warehouses, perform data wrangling, conduct hypothesistesting, and utilize various analytical models to gain valuable insights from data.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION TO DATA WAREHOUSE** | **08 HOURS** |

**Applications/Case Study:** Retail-Industry Case Study

**Contents:** Introduction to Data Science and Data Mining, Descriptive, Predictive and Prescriptive Data Analysis Techniques.

Introduction to Data Warehouse, DW Architecture, DW Characteristics, ETL, Introduction to Business Intelligence. Applications of BI. Distributed Data Warehouse, Real Time Data Warehouse Architecture. Data lakes

**Self Study:** Data Warehouse Security Measures: User access, Data load, Data movement, Query generation

**Further Readings:** Advancement Data Collection Security

| | | |
|---|---|---|
| **UNIT 2** | **ONLINE ANALYTICAL PROCESSING** | **06 HOURS** |

**Applications/Case Study:** Retail-Industry Case Study

**Contents:** Online Analytical Processing, difference between Online Transaction processing, types of OLAP techniques, survey of several OLAP techniques. Making cubes, performing Cube operations- Roll up, Drill down, slice, dice and pivot, OLAP Queries, Data Cube Computations.

**Self Study:** Data visualization techniques

**Further Readings:** Cubing Service Security, Multidimensional Data Analysis.

| | | |
|---|---|---|
| **UNIT 3** | **DATA WRANGLING AND HYPOTHESIS TESTING** | **09 HOURS** |

**Applications/Case Study:** Retail-Industry Case Study

**Contents:** Concept of Data wrangling and various techniques of data wrangling, case study on data wrangling, Descriptive Statistics. Null Hypothesis, Alternative Hypothesis, Type-I and Type-II Error, Inferential Statistics through Hypothesis Tests, Z-Test, T-Test, Chi Square Test, ANOVA, F Test **Self Study:** Probability distributions

**Further Readings:** Randomization Test

| UNIT 4 | REGRESSION AND CORRELATION | 08 HOURS |
|---|---|---|
| **Applications/Case Study:** Real Estate Case Study<br>**Contents:** Concept of regression, overfitting, under fitting, bias, variance. Gradient Descent. Simple Regression, Multiple Regression, Linear-Logistic Regression, Poisson Regression, Non-Linear Regres- sion. Correlation Coefficient, Measuring Performance of a Model, Accuracy, ROC Curves, Precision- Recall Curves.<br>**Self Study:** Regression Models using Excel 2013<br>**Further Readings:** Correlation Mining for Massive data | | |
| **UNIT 5** | **ASSOCIATION AND CO-OCCURRENCES** | **09 HOURS** |
| **Applications/Case Study:** Real time case studies ( Retail/ Hospital/Hotel etc)<br>**Contents:** Association rules, Apriori algorithm- simple, multi-level, multi dimensional, Eclat and FP growth. Comparative study of all Association algorithms.<br>**Self Study:** Frequent itemset concepts<br>**Further Readings:** Adaptive Apriori Algorithm | | |
| **UNIT 6** | **CLASSIFICATION MODELS USING DECISION TREE** | **05 HOURS** |
| **Applications/Case Study:** Loan defaulter detection/disease detection/recession predictions etc.<br>**Contents:** Decision trees based on Information Gain, Gain Ratio and Gini index. Comparative Analysis of all Decision tree based algorithms with different case studies.<br>**Self Study:** Different Learning Types<br>**Further Readings:** CART advancements | | |

**TEXT BOOKS**


1. Jiawei Han, Micheline Kamber, Jian Pei Professor.(2011). "Data Mining: Concepts and Tech- niques", The Morgan Kaufmann Series in Data Management Systems, ISBN 978-9380931913.
2. Rick Sherman.(2014). "Business Intelligence Guidebook: From Data Integration to Analytics", The Morgan Kaufmann Series in Data Management Systems, ISBN 0124114616.
3. Sheldon Ross. (2017). "Introductory Statistics", Academic Press; 4th edition, Hardcover ISBN: 9780128043172 eBook ISBN: 9780128043615.
4. John D. Kelleher,Brian Mac Namee,Aoife D'Arcy.(2015), Fundamentals of Machine Learning for Predictive Data Analytics Algorithms, Worked Examples, and Case Studies.The MIT Press,ISBN-10:0262029448
5. Stephen Marsland(2015).Machine Learning: An Algorithmic Perspective, Second Edition Part of: Chapman Hall/Crc Machine Learning Pattern Recognition (21 Books). CRC Press.
6. McKinney, Wes.(2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. O'Reilly Media, Inc.


**REFERENCE BOOKS**


1. Paulraj Ponniah. (2012)."Data Warehousing: Fundamentals for IT Professionals", 2nd Edition, Paperback, Wiley Publishers, ISBN 978-8126537297.
2. Ralph Kimball.(2009), "Data Warehouse Lifecycle Toolkit", Wiley, ISBN 978-0470149775
3. Maria Sueli Almeida, Missao Ishikawa, Joerg Reinschmidt, Torsten Roeber. (1999). "Getting Started with Data Warehouse and Business Intelligence", IBM Redbook, ISBN 978-0738413747.
4. Ramesh Sharda, DursunDelen, Efraim Turban. (2019). "Business Intelligence, Analytics, and Data Science: A Managerial Perspective", Pearson Publication, 4th Edition, ISBN 978- 9353067021.
5. Murrey R Spiegal, Larry Stiphens.(2018). "Statistics" , 5th edition ,Schaum's Series, McGraw- Hill Education; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527


**E-RESOURCES**

1. https://dl.acm.org/doi/abs/10.5555/861541
2. https://doi.org/10.1016/j.gltp.2024.020
3. https://doi.org/10.1007/s10462-022-10275-5
4. https://www.scribbr.com/statistics/hypothesis-testing/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | EXPLORATORY DATA ANALYTICS LAB |
| | COURSE CODE | 2304321L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Essential of Data Science, Applied Mathematics

**COURSE OBJECTIVES :**

2304321L.CEO.1: To esign dimensional model for given data warehouse architecture.
2304321L.CEO.2: To apply the various operations on OLAP cubes.
2304321L.CEO.3: To apply data preprocessing and visualization techniques
2304321L.CEO.4: To analyze numeric prediction using regression models
2304321L.CEO.5: To use the different association rule generation algorithms
2304321L.CEO.6: To apply decision tree based classifiers on given case study

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304321L.CO.1: Apply Data wrangling , Data modeling and predictive analytics concepts on given problem statements. [L3]
2304321L.CO.2: Analyze the efficiency of the different techniques/ algorithms on the given case study and write an article on the same without plagiarism. [L4]

**COURSE ABSTRACT:**

Descriptive Analytics is the first course under Data Science track. Descriptive Analytics is a founda- tional course designed to equip students with the essential skills and knowledge necessary to extract actionable insights from data. This course provides a comprehensive overview of various techniques and methodologies utilized in descriptive analytics, focusing on data preprocessing, analysis, and interpretation. Students will learn how to leverage data warehouses, perform data wrangling, conduct hypothesis testing, and utilize various analytical models to gain valuable insights from data.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Design Data Warehouse** | **4 HOURS** |
| Data Modeling, Types of Dimensions and Facts, Granularity of Facts, Measures and Categorization of Measures, Making of Data Mart, Scheme Modeling (Star, Snowflake, Star Constellation Schema), Case Studies on Dimensional Modeling) | | |
| **PRACTICAL NO.02** | **Analytical Data Preprocessing** | **4 HOURS** |
| Writing OLAP queries for the case study from Assignment no.1 Making Cubes using OLAP tools. | | |
| **PRACTICAL NO.03** | **Apply Data Wrangling** | **4 HOURS** |
| Data wrangling/Curation project along with data visualization. | | |
| **PRACTICAL NO.04** | **Implemtation of Regression** | **6 HOURS** |
| Apply correct Regression model for the given application (Simple, Multiple, Polynomial, Logistic) | | |
| **PRACTICAL NO.05** | **Analysis of Associations** | **6 HOURS** |
| Analysis and optimization of Association techniques for given problem statements. | | |
| **PRACTICAL NO.06** | **Application of Classiftcation Techniques** | **6 HOURS** |
| Application based implementation of Decision tree based Classification algorithms | | |

**TEXT BOOKS**


1. Jiawei Han, Micheline Kamber, Jian Pei Professor.(2011). "Data Mining: Concepts and Tech- niques", The Morgan Kaufmann Series in Data Management Systems, ISBN 978-9380931913.
2. Rick Sherman.(2014). "Business Intelligence Guidebook: From Data Integration to Analytics", The Morgan Kaufmann Series in Data Management Systems, ISBN 0124114616.
3. Sheldon Ross. (2017). "Introductory Statistics", Academic Press; 4th edition, Hardcover ISBN: 9780128043172 eBook ISBN: 9780128043615.
4. John D. Kelleher,Brian Mac Namee,Aoife D'Arcy.(2015), Fundamentals of Machine Learning for Predictive Data Analytics Algorithms, Worked Examples, and Case Studies.The MIT Press,ISBN-10:0262029448
5. Stephen Marsland(2015).Machine Learning: An Algorithmic Perspective, Second Edition Part of: Chapman Hall/Crc Machine Learning Pattern Recognition (21 Books). CRC Press.
6. McKinney, Wes.(2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. O'Reilly Media, Inc.


**REFERENCE BOOKS**


1. Paulraj Ponniah. (2012)."Data Warehousing: Fundamentals for IT Professionals", 2nd Edition, Paperback, Wiley Publishers, ISBN 978-8126537297.
2. Ralph Kimball.(2009), "Data Warehouse Lifecycle Toolkit", Wiley, ISBN 978-0470149775
3. Maria Sueli Almeida, Missao Ishikawa, Joerg Reinschmidt, Torsten Roeber. (1999). "Getting Started with Data Warehouse and Business Intelligence", IBM Redbook, ISBN 978-0738413747.
4. Ramesh Sharda, DursunDelen, Efraim Turban. (2019). "Business Intelligence, Analytics, and Data Science: A Managerial Perspective", Pearson Publication, 4th Edition, ISBN 978- 9353067021.
5. Murrey R Spiegal, Larry Stiphens.(2018). "Statistics" , 5th edition ,Schaum's Series, McGraw- Hill Education; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527


**E-RESOURCES**

1. https://dl.acm.org/doi/abs/10.5555/861541
2. https://doi.org/10.1016/j.gltp.2024.020
3. https://doi.org/10.1007/s10462-022-10275-5
4. https://www.scribbr.com/statistics/hypothesis-testing/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Artificial Intelligence and Machine Learning |
| | COURSE CODE | 2304322T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** Application Programming.

**COURSE OBJECTIVES :**

2304322T.CEO.1: Provide strong foundation of fundamental Artificial Intelligence concepts of Perception, Knowledge, Inference and Search Strategies.

2304322T.CEO.2: Present optimal methodologies and evaluating the effectiveness of statistical machine learning models.

2304322T.CEO.3: Provide the knowledge about various statistical machine learning models to build computational intelligence.

2304322T.CEO.4: Illustrate diverse applications of machine learning across various domains and real world scenarios.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304322T.CO.1: Apply basic principles of Perception, Knowledge Representation, Inference, Reasoning and Search Strategies in Artificial Intelligence [L3].

2304322T.CO.2: Utilize various machine learning statistical algorithms in a range of real-world applications [L3].

2304322T.CO.3: Evaluate the performance of machine learning models through systematic hyper-parameter optimization [L4].

2304322T.CO.4: Analyze the strengths and limitations of different AI and ML approaches [L4].

**COURSE ABSTRACT:**

This course aims to introduce the fundamental concepts of artificial intelligence to individuals from all academic backgrounds. Students will develop a broad understanding of AI technologies, their implications, and their potential applications in various fields.AI can do many things, it currently cannot perform and think exactly like human beings ,but General AI is like what you see in sci-fi films, where sentient machines emulate human intelligence, thinking strategically, abstractly and creatively, with the ability to handle a range of complex tasks.In this course introduce the machine learning field, which can be briefly defined as enabling computers make successful classification,clustering ,predictions by using regression model as well as using past experiences, has exhibited an impressive development recently with the help of the rapid increase in the storage capacity and processing power of computers. Natural language processing (NLP) is the ability to process natural, human-created text. Neural networks help computers gather insights and meaning from text data and documents. NLP has several use cases, including in these functions: Automated virtual agents and chatbots.IN this course introduced Neural Network as wel,Neural networks can help computers make intelligent decisions with limited human assistance. This is because they can learn and model the relationships between input and output data

**THEORY COURSE CONTENTS**

| UNIT 1 | BASICS OF ARTIFICIAL INTELLIGENCE | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Medical Diagnosis System, Self Driving Vehicle.

**Contents:** Foundation and history of Artificial Intelligence (AI), AI applications and types, Impact and ethical concerns of AI, Intelligent Agents. Introduction to Reasoning and Knowledge Representation, First order Logic, Rule based reasoning, Architecture of expert systems, Knowledge Acquisition.

**Self Study:** Chatbot, Prompt Engineering

**Further Readings:** Artificial General Intelligence.

| UNIT 2 | AI SEARCH STRATEGIES | 08 HOURS |
|---|---|---|

**Applications/Case Study:** GPS Navigation System, Chess Game

**Contents:** Search Strategies: State Space Search, Uninformed Search (Breadth-First, Depth-First, Depth Limited, Iterative Deepening, Bidirectional), Heuristic Search (Greedy Best First Search, A* Al- gorithm, Admissibility of A*), Hill-climbing, Constraint Satisfaction Problem(CSP), Constraint Prop- agation and Inference in CSP, Local Search and Backtracking Search in CSP. Adversarial Search, Minimax Search, Alpha-Beta Pruning.

**Self Study:** Genetic Algorithm

**Further Readings:** Game Theory

| UNIT 3 | MACHINE LEARNING FUNDAMENTALS | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Real Estate Price Prediction, Healthcare Application.

**Contents:** Overview of Machine learning: Supervised, Unsupervised and Reinforcement Learning. Regression, Types of regression: Simple and Multiple Linear Regression, Polynomial Regression, Evaluation Metrics for Regression Models: Mean Squared Error, Root Mean Squared Error, Mean Absolute Error, and R-squared value.

**Self Study:** Ridge Regression, Lasso Regression, Elastic Net Regression

**Further Readings:** K-Fold Cross-Validation case study.

| UNIT 4 | INSTANCES AND PROBABILISTIC MODEL | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Customer Churn Prediction.

**Contents:** Naive Bayes: Bayes' theorem, Independence Assumption, Logistic Regression for Classification, Model Evaluation Metrics: Accuracy, Precision, Recall, F1, Confusion Matrix, ROC-AUC. **Self Study:** k-Nearest Neighbors (KNN) for Regression and Classification.

**Further Readings:** Variation Inference.

| UNIT 5 | LINEAR AND DECISION MODELS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Pima Diabetes Prediction

**Contents:** Decision Trees, Gini Impurity, Information Gain, Pruning. Support

Vector Machines: Hyperplane, Support Vectors and Kernel Types.

Ensemble learning: Significance, Bagging, Boosting and Stacking. Performance Evaluation of Machine Learning Models.

**Self Study:** Adaboost Ensemble Learning.

**Further Readings:** Decision Tree for Regression Analysis.

| UNIT 6 | UNSUPERVISED LEARNING MODELS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Anomaly Detection and Noise Reduction

**Contents:** Association Rule, Apriori Algorithm.

Introduction to Clustering, Partitional Clustering, Hierarchical Clustering, Density Based Clustering.

Dimensionality Reduction, Feature Selection and Extraction, Principal Component Analysis.

**Self Study:** Probability Distribution Based Methods.

**Further Readings:** Linear Discriminant Analysis.

**TEXT BOOKS**


1. Stuart Russel and Peter Norvig(2020). *Artificial Intelligence: A Modern Approach*. 4th Edition, Pearson . ISBN: 0-13-461099-7. Rich, Kevin Knight(2020). *Shivashankar B. Nair, Artificial Intelligence,*. 3rd Edition, TataMcGraw Hill. ISBN-13: 978-0-07-008770-5.
2. Ethem Alpaydin(2020). *Introduction to Machine Learning*. 4th Edition,The MIT Press publica- tion. ISBN:978-0-262-04379-3.
3. S. Harrington (1987). *Computer Graphics*. 2nd Edition, McGraw-Hill publication. ISBN 0-07- 100472-6.
4. Tom Mitchell(1997). *Machine Learning*. 2nd Edition, Tata McGraw-Hill publication, ISBN 007- 0-42807-7.
5. Jason Bell(1994). *"Machine Learning: Hands-On for Developers and Technical Professionals*. 2nd Edition,Willey Publication,ISBN-10: 8126553375, ISBN-13: 978- 8126553372.
6. James, G., Witten, D., Hastie, T. and Tibshirani, R(2013). *An Introduction to Statistical Learning*,Springier Publication,VOL 112.


**REFERENCE BOOKS**


1. Deepak Khemani (2013). *A First course in Artificial Intelligence*. 1st Edition, Mc Graw Hill,ISBN: 9781259029981.
2. Peter Harrington (2012)*Machine Learning in Action*. 2nd Edition, Dreamtech Press,ISBN 978-1-617-29018-3.
3. *Trevor Hastie,Robert Tibshirani, Jerome Friedman*. The Elements of Statistical Learning: Data Mining,Inference and Prediction 3rd Edition,ISBN: 978-0-387-84857-0.
4. Christopher M. Bishop(2016)*"Pattern Recognition and Machine Learning*. 4th Edition, Springier New York.
5. *Andrea's Muller*.Introduction to Machine Learning with Python: A Guide for Data Scientists(2016),1st Edition,Shroff/O'Reilly,ISBN-10: 9352134575, ISBN-13: 978-9352134571.


**E-RESOURCES**

1. https://nptel.ac.in/courses/106105078.
2. https://nptel.ac.in/courses/106106126
3. https://nptel.ac.in/courses/106106139

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Artificial Intelligence and Machine Learning Lab |
| | COURSE CODE | 2304322L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**COURSE OBJECTIVES :**

2304322L.CEO.1: Incorporate theoretical understanding into real-world scenarios and applications of artificial intelligence.

2304322L.CEO.2: Elaborate various feature engineering and dimensionality reduction approaches for improving model performance.

2304322L.CEO.3: Design intelligent expert models for perception and prediction from intelligent environment.

2304322L.CEO.4: Enhance understanding of selecting and applying AI tools for synthesizing information and building models within application constraints.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304322L.CO.1: Apply AI techniques, including searching and game playing, to address challenging real-life problems represented in state spaces.[L3].

2304322L.CO.2: Organize dataset to improve model performance.[L4].

2304322L.CO.3: Conduct experiments to evaluate the strengths and limitations of various AI and ML approaches. [L4].

2304322L.CO.4: Evaluate results to draw conclusions on problem-solving method effectiveness.[L5].

2304322L.CO.5: Deploy machine learning models into production environments.[L5].

**COURSE ABSTRACT:**

This course aims to introduce the practical knowledge in artificial intelligence to individuals from all academic backgrounds. Students will develop search stategy like vaccum cleaning agent, A* algorithm / technologies, their implications, and their potential applications in various fields.In this course student can able to develop the machine learning algorithms, which can be briefly defined as enabling computers make successful classification,clustering ,predictions by using regression model. Implete programs using Natural language processing (NLP) is the ability to process natural language model, human-created text. Implement Neural networks with the help of computers gather insights and meaning from text data and documents. NLP has several use cases, including in these functions: Automated virtual agents and chatbots

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Assignment 1** | **2 HOURS** |
| a) Develop Vacuum Cleaner Agent Application. b) Develop an knowledge base system consisting of facts and rules about some specialized knowledge domain of your choice. | | |
| **PRACTICAL NO.02** | **Assignment 2** | **2 HOURS** |
| Find the shortest path for any particular source and destination using A* Algorithm. OR Design and implement map coloring problem using backtracking. | | |
| **PRACTICAL NO.03** | **Assignment 3 -Regression Model** | **6 HOURS** |
| 1. Data Preparation and Model Implementation - • Select suitable dataset with continuous target variables. • Preprocess data, handle missing values, and encode categorical features.<br>2.Model Design and Implementation - • Use Linear regression,Polynomial and Multivariate regression<br>3.Model Training and Evaluation - • Split dataset into training and testing sets. • Train each model on training set. • Evaluate models using appropriate metrics(MSE,RMSE,R2)<br>4.Comparative Analysis - • Compare performance of various regression models. • Analyze strengths, weaknesses, interpretability, computational efficiency, and model complexity.<br>5.Conclusion - •Summarize findings, provide recommendations, and discuss improvement areas. | | |

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.04** | **Assignment 4 -Classiftcation Model** | **8 HOURS** |
| 1. Data Preprocessing: Prepare the dataset by handling missing values, encoding categorical variables, and scaling features.<br>2. Model Implementation: Develop classification models using SVM, Decision Trees (CART), KNN, and Naive Bayes.<br>3. Training and Evaluation: Train each model on a portion of the dataset and evaluate their performance using relevant metrics (accuracy, precision, recall, F1-score,loss).<br>4. Comparative Analysis: Compare the results obtained from each algorithm to identify patterns and differences.<br>5. Conclusion: Summarize the findings and discuss the suitability of each algorithm for various classification tasks. | | |
| **PRACTICAL NO.05** | **Lab Assignment 5: Ensemble Learning in Classift- cation: A Comprehensive Analysis of Stacking, Ad- aBoost, and Voting** | **6 HOURS** |
| 1. Dataset Selection and Preprocessing:Preprocess images from selected dataset for resizing, normalization, and data augmentation.<br>2. Stacking: Implement a stacking ensemble using a meta-classifier to combine predictions from base classifiers.<br>3. AdaBoost: Implement an AdaBoost ensemble using chosen base classifiers.<br>4. Voting: Implement a voting ensemble that combines the predictions of the base classifiers through majority voting.<br>5. Model Comparison: Compare the performance of the ensemble models using appropriate classification metrics.<br>6. Analysis and Interpretation: Analyze the strengths and weaknesses of each ensemble method, explore scenarios where one method may outperform the others, and discuss the impact of diversity among base classifiers on ensemble performance.<br>7. Conclusion: Summarize the findings, provide insights into when to use each ensemble method, and suggest potential areas for further research or improvement. | | |
| **PRACTICAL NO.06** | **Lab Assignment 6: Lab Assignment 6: K-means Clustering** | **4 HOURS** |
| Implement K-means clustering and Hierarchical clustering for selected dataset. Compute the following,<br>1. K-Means: Compute the squared error for k=3 and k=4 clusters<br>2. K-Means: Find optimum number of clusters<br>3. compute (and store) the squared errors of all possible clustering in hierarchical clustering<br>4. Compare k-means and hierarchical clustering with respect to error and optimum number of clusters. | | |

| PRACTICAL NO.07 | Mini Project | 6 HOURS |
|---|---|---|

Objective: 1.Design and implement a machine learning model for predictive maintenance.
Deploy the model to the cloud for real-time predictions.
2.Tasks:
Dataset Selection and Exploration:
a)Preprocess images from selected dataset for resizing, normalization, and data augmentation.
b)Classification: Label instances indicating impending equipment failure.
c)Regression: Predict the remaining useful life of equipment.
3.Model Development:
a)Implement a classification model OR
b)Implement a regression model
c)Evaluate the models using appropriate metrics.
4.Model Deployment to Cloud:
a) Choose a cloud platform for deployment.
b) Deploy the trained models using cloud services.
c) Create a REST API for real-time predictions.
5.Integration with a Web Application or
Product:
a) Develop a simple interface to interact with the deployed models.
b) Allow users to input relevant features for prediction.
6.Documentation: Provide clear documentation for the entire
project.
7.Testing and Validation:Perform thorough testing of the deployed models and the web application.
8.Conclusion and Future Work: Summarize project objectives, methods, and outcomes and Discuss potential areas for improvement or extension.

**TEXT BOOKS**


1. Stuart Russel and Peter Norvig(2020). *Artificial Intelligence: A Modern Approach*. 4th Edition, Pearson . ISBN: 0-13-461099-7. Rich, Kevin Knight(2020). *Shivashankar B. Nair, Artificial Intelligence,*. 3rd Edition, TataMcGraw Hill. ISBN-13: 978-0-07-008770-5.
2. Ethem Alpaydin(2020). *Introduction to Machine Learning*. 4th Edition,The MIT Press publica- tion. ISBN:978-0-262-04379-3.
3. S. Harrington (1987). *Computer Graphics*. 2nd Edition, McGraw-Hill publication. ISBN 0-07- 100472-6.
4. Tom Mitchell(1997). *Machine Learning*. 2nd Edition, Tata McGraw-Hill publication, ISBN 007- 0-42807-7.
5. Jason Bell(1994). *"Machine Learning: Hands-On for Developers and Technical Professionals*. 2nd Edition,Willey Publication,ISBN-10: 8126553375, ISBN-13: 978- 8126553372.
6. James, G., Witten, D., Hastie, T. and Tibshirani, R(2013). *An Introduction to Statistical Learning*.Springier Publication VOL 112


**REFERENCE BOOKS**


1. Deepak Khemani (2013). *A First course in Artificial Intelligence*. 1st Edition, Mc Graw Hill,ISBN: 9781259029981.
2. Peter Harrington (2012)*Machine Learning in Action*. 2nd Edition, Dreamtech Press,ISBN 978-1-617-29018-3.
3. *Trevor Hastie,Robert Tibshirani, Jerome Friedman*. The Elements of Statistical Learning: Data Mining,Inference and Prediction 3rd Edition,ISBN: 978-0-387-84857-0.
4. Christopher M. Bishop(2016)*"Pattern Recognition and Machine Learning*. 4th Edition, Springier New York.
5. *Andrea's Muller*.Introduction to Machine Learning with Python: A Guide for Data Scientists(2016),1st Edition,Shroff/O'Reilly,ISBN-10: 9352134575, ISBN-13: 978-9352134571.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | CLOUD COMPUTING FOUNDATIONS |
| | COURSE CODE | 2304323T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PRE-REQUISITE KNOWLEDGE :** Data Structures, Database Management Systems, Discrete Structures and Graph Theory

**COURSE OBJECTIVES :**

2304323T.CEO.1: To introduce various cloud computing services and models

2304323T.CEO.2: Enable students to strategize the selection of optimal configurations for compute nodes

2304323T.CEO.3: To configure appropriate storage service for the specific application requirement

2304323T.CEO.4: To implement networking and security settings in cloud environment

2304323T.CEO.5: To create the application using high scalability and reliability considerations

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304323T.CO.1: Categorize different types of cloud computing services and models [L3]. 2304323T.CO.2: Choose appropriate compute service configuration within a cloud environment [L3]. 2304323T.CO.3: Distinguish between storage-related services utilized in application development[L3]. 2304323T.CO.4: Choose the suitable database service for a given application scenario [L3].

2304323T.CO.5: Evaluate various networking and security [L5]. configurations based on specific problem-solving requirements [L3].

2304323T.CO.6: To examine different networking and security choices while developing an application [L3]

**COURSE ABSTRACT:**

Cloud Computing Foundations is one of the fundamental course to implement various Service Models and Deployment Models to be used to solve real world problems. Cloud Computing Foundations Lab assignments are designed for both Service Models and Deployment Models concepts. This course implements various operations of collecting, organizing and storing of data in an efficient way in order to solve real time problems. Learners cultivate broad and in depth knowledge of synthesizing and analyzing Service Models using appropriate compute, storage and network services in order to provide solutions to real world problems. The objective of the course is to identify global infrastructure components of AWS, understand and demsotrate AWS EC2 Load Balancing EBS, EFS S3 Auto Scaling.

**THEORY COURSE CONTENT**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Cloud Computing** | **8 HOURS** |

**App/System/Case study:** Amazon AWS, Microsoft Azure, Salesforce

**Contents:** Recent trends in Computing - Grid Computing, Cluster Computing, Utility Computing, Cloud Computing. Evolution of cloud computing - Business driver for adopting cloud computing Distinguishing Cloud Types, Deployment Models, Service Models, Scalability, Virtualization, Software as a service (SaaS): understanding multitenant nature, service oriented architecture, Platform as a service (PaaS): Benefits and disadvantages, Infrastructure as a service (IaaS)

Web as a portal to cloud : Overview of web protocols like HTTP, SOAP, REST and XML. Virtualization : types, hypervisors.

Cloud economics and billing

**Self study:** Hybrid cloud service providers

**Further Reading:** REST implementation

| | | |
|---|---|---|
| **UNIT 2** | **Networking and Security Services in Cloud Computing** | **9 HOURS** |

**App/System/Case study:** Amazon VPC, Amazon Route S3, Amazon Elastic Load Balancing, Ama- zon Cloud Front

**Contents:** Building cloud network(VPC) : defining and provisioning isolated networks, gateways in cloud, providing private connectivity in hybrid cloud environments Scaling cloud network : automatic traffic distribution across pool of servers, direct traffic routing for achieving performance Securing net- work traffic : Configuring and managing firewall rules, access permission,Security Groups and NACLs Identity and Access Management in Cloud Network: Users, Groups, Roles, Permission Policies, Per- mission Boundary, Service Control Policies

**Self study:** Advanced Firewall Settings

**Further Reading:** VPN Connectivity in AWS

| UNIT 3 | Compute Services in Cloud Computing | 7 HOURS |
|---|---|---|
| **App/System/Case study:** Amazon EC2, Virtualbox, Docker<br>**Contents:** Compute node architecture, parameters to consider while configuring compute node, Ma- chine images, instances, instance types, tags, key pairs, security groups, regions and zones – types User data and metadata for instance, instance tenancy<br>**Self study:** Kubernetes<br>**Further Reading:** Virtual Machine Internal XML file | | |
| **UNIT 4** | **Storage Services in Cloud Computing** | **6 HOURS** |
| **App/System/Case study:** Amazon S3, Amazon EBS, Amazon EFS, Amazon Glacier<br>**Contents:** Examining the Evolution of Network Storage, Understanding Cloud-Based Data Storage, Advantages and Disadvantages of Cloud-Based Data Storage. Cloud- Based Backup Systems<br>Types of cloud storage – File Storage - EFS, Block Storage – Elastic Block Storage, Object Based Storage – S3<br>**Self Study:** Google File System<br>**Further Reading:** CEPH File System | | |
| **UNIT 5** | **Database Services in Cloud Computing** | **8 HOURS** |
| **App/System/Case study:** Amazon RDS, Amazon DynamoDB, Amazon ElastiCache, Amazon Nep- tune<br>**Contents:** Need for cloud databases, considerations for cloud databases, architecture and common characteristics, Data Models<br>Relational database, Key – value based database, In-memory database, Document based database, Graph based database, Time series database, Ledger based database.<br>High availability and load balancing in databases<br>**Self Study:** Real time graph databases<br>**Further Reading:** Blockchain | | |
| **UNIT 6** | **High Availability and Scalability Services in Cloud Computing** | **7 HOURS** |
| **App/System/Case study:** Amazon EC2, Amazon EBS, AWS Autoscaling<br>**Contents:** Definition, elements of high availability. High availability for compute resources, high avail- ability for databases and high availability for storage services.<br>Elastic Load Balancing – Types of load balancers, Target Groups, Health monitoring autoscaling Groups: Scaling policies, Launch templates, Min, Max and Desired counts .<br>Scalability issues, vertical scaling vs. horizontal scaling vs. diagonal scaling, difference between scala- bility and elasticity<br>**Self Study:** Autoscalling algorithms<br>**Further Reading:** Highly available and salable file system features | | |

**TEXT BOOK**


1. Wittig, Michael, Andreas Wittig and Ben Whaley (2023). *Amazon web services in action*. 3rd Edition,Manning, ISBN 9781633439160.
2. Murty, James, Andreas Wittig and Ben Whaley (2008). *Programming amazon web services: S3, EC2, SQS, FPS, and SimpleDB*. O'Reilly Media, Inc., ISBN 9780596515812.
3. David Clinton and Ben Piper (2021). *AWS Certified Solutions Architect Study Guide - Associate SAA-C02 Exam*. 3rd Edition,Sybex, ISBN 1119713080.
4. Albert Anthony (2017). *Mastering AWS Security,: Create and maintain a secure cloud ecosystem*, Packt Publishing Limited, ISBN 9781788293723.
5. van Vliet, Jurg, Flavia Paganelli, and Jasper Geurtsen (2013). *Resilience and Reliability on AWS*. 1st Edition,O'Reilly Media, ISBN 9789351100010.
6. Sarkar, Aurobindo, and Amit Shah (2018). *Learning AWS: Design, build, and deploy responsive applications using AWS Cloud components*. 2nd Edition,Packt Publishing Limited, ISBN 9781787281066


**REFERENCE BOOK**


1. Michael J. Kavis (2014). *Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)*. 1st Edition,Wiley CIO, ISBN 9781118617618
2. Wittig, John R. Vacca (2016). *Cloud Computing Security: Foundations and Challenges*. 1st Edition,CRC Press, ISBN 9781482260946.
3. Furht, Borivoje, and Armando Escalante (2010). *Handbook of Cloud Computing*. 3rd Edition,Springer, ISBN 9781441965233.


**E-R ESOURCES**

1. https://docs.aws.amazon.com/
2. https://www.workshops.aws/
3. https://www.terraform.io/
4. https://boto3.amazonaws.com/v1/documentation/api/latest/index.html

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | (Rev. (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | CLOUD COMPUTING FOUNDATIONS LAB |
| | COURSE CODE | 2304323L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE KNOWLEDGE :** Data Structures, Database Management Systems, Discrete Structures and Graph Theory

**COURSE OBJECTIVES :**

2304323L.CEO.1: To introduce various cloud computing services and models

2304323L.CEO.2: Enable students to strategize the selection of optimal configurations for compute nodes

2304323L.CEO.3: To configure appropriate storage service for the specific application requirement

2304323L.CEO.4: To implement networking and security settings in cloud environment

2304323L.CEO.5: To create the application using high scalability and reliability considerations

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304323L.CO.1: Categorize different types of cloud computing services and models [L3]. 2304323L.CO.2: Choose appropriate compute service configuration within a cloud environment [L3]. 2304323L.CO.3: Distinguish between storage-related services utilized in application development [L3]. 2304323L.CO.4: Choose the suitable database service for a given application scenario [L3].

2304323L.CO.5: Evaluate various networking and security [L3]. configurations based on specific problem-solving requirements [L5].

2304323L.CO.6: To examine different networking and security choices while developing an application [L4]

**COURSE ABSTRACT:**

Cloud Computing Foundations is one of the fundamental course to implement various Service Models and Deployment Models to be used to solve real world problems. Cloud Computing Foundations Lab assignments are designed for both Service Models and Deployment Models concepts. This course implements various operations of collecting, organizing and storing of data in an efficient way in order to solve real time problems. Learners cultivate broad and in depth knowledge of synthesizing and analyzing Service Models using appropriate compute, storage and network services in order to provide solutions to real world problems. The objective of the course is to identify global infrastructure components of AWS, understand and demsotrate AWS EC2 Load Balancing EBS, EFS S3 Auto Scaling.

**PRACTICAL:**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **First Virtual Machine on AWS** | **4 HOURS** |
| Launching the virtual machine on Amazon AWS and doing basic settings | | |
| **PRACTICAL NO.02** | **Storage Conftguration** | **4 HOURS** |
| Configuring various storages available on AWS and storing, retrieving, deleting the data from those storage applications | | |
| **PRACTICAL NO.03** | **Database Conftguration** | **4 HOURS** |
| Configuring and using various databases available on Amzon AWS | | |
| **PRACTICAL NO.04** | **Networking and Security Services Conftguration** | **6 HOURS** |
| Configuring various networking and security options | | |
| **PRACTICAL NO.05** | **High availability and scalability services** | **4 HOURS** |
| Configuration of high availability and scalability services | | |
| **PRACTICAL NO.06** | **Project** | **6 HOURS** |
| Implement a project based on all the services studied for a given application on Amazon AWS | | |

**TEXT BOOK**


1. Wittig, Michael, Andreas Wittig and Ben Whaley (2023). *Amazon web services in action*. 3rd Edition,Manning, ISBN 9781633439160.
2. Murty, James, Andreas Wittig and Ben Whaley (2008). *Programming amazon web services: S3, EC2, SQS, FPS, and SimpleDB*. O'Reilly Media, Inc., ISBN 9780596515812.
3. David Clinton and Ben Piper (2021). *AWS Certified Solutions Architect Study Guide - Associate SAA-C02 Exam*. 3rd Edition,Sybex, ISBN 1119713080.
4. Albert Anthony (2017). *Mastering AWS Security,: Create and maintain a secure cloud ecosystem*, Packt Publishing Limited, ISBN 9781788293723.
5. van Vliet, Jurg, Flavia Paganelli, and Jasper Geurtsen (2013). *Resilience and Reliability on AWS*. 1st Edition,O'Reilly Media, ISBN 9789351100010.
6. Sarkar, Aurobindo, and Amit Shah (2018). *Learning AWS: Design, build, and deploy responsive applications using AWS Cloud components*. 2nd Edition,Packt Publishing Limited, ISBN

**REFERENCE BOOK**


1. Michael J. Kavis (2014). *Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)*. 1st Edition,Wiley CIO, ISBN 9781118617618
2. Wittig, John R. Vacca (2016). *Cloud Computing Security: Foundations and Challenges*. 1st Edition,CRC Press, ISBN 9781482260946.
3. Furht, Borivoje, and Armando Escalante (2010). *Handbook of Cloud Computing*. 3rd Edition,Springer, ISBN 9781441965233.


**E-R ESOURCES**

1. https://docs.aws.amazon.com/
2. https://www.workshops.aws/
3. https://www.terraform.io/
4. https://boto3.amazonaws.com/v1/documentation/api/latest/index.html

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | CRYPTOGRAPHY AND INFORMATION SECURITY |
| | COURSE CODE | 2304324T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** Requires knowledge of Computer Networks, calculus, and basic linear algebra

**COURSE OBJECTIVES :**

2304324T.CEO.1: To prepare Cryptography theories, algorithms, and systems.
2304324T.CEO.2: To Explain necessary Approaches and Techniques to build protection mechanisms to secure information.
2304324T.CEO.3: To understand the basic categories of threats to computers and their information.
2304324T.CEO.4: To approach the fundamental ideas of public-key cryptography and symmetric key cryptography.
2304324T.CEO.5: Critically discuss IP Security, Web security, and Firewalls

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304324T.CO.1: Examine the security threats and the security mechanisms to counter them.
[L3] 2304324T.CO.2: Apply security principles to protect the data.[L3].
2304324T.CO.3: Demonstrate common symmetric and asymmetric encryption algorithms used as standards in modern cryptosystems [L3].
2304324T.CO.4: Compare the properties of hash algorithms in digital signature. [L4]
2304324T.CO.5: Analyze information security policies.[L5]
2304324T.CO.6: Inspection network security threats and provide solutions to protect the network [L5]

**COURSE ABSTRACT:**

This course will deal with the construction and analysis of different security techniques that prevent third parties from reading private data between two parties. Cryptography has evolved to address the encryption and decryption of user data through the internet and computer systems. It is a branch of cyber and network security.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION OF SECURITY IN COMPUTING ENVI- RONMENT** | **07 HOURS** |

**Applications/Case Study:**Threats, Vulnerabilities, and Controls.

**Contents:** Introduction to the concepts of Security, Need for Security; Security Attacks, Types of Attacks, Classical and Modern Cryptography; Security Services and Mechanisms. Substitution Techniques, Transposition Techniques, Chinese Remainder theorem, and Cryptography techniques.

**Self Study:** : Prime numbers

**Further Readings:** stenography Foundations of modern cryptography.

| | | |
|---|---|---|
| **UNIT 2** | **SYMMETRIC KEY CRYPTOGRAPHY** | **08 HOURS** |

**Applications/Case Study:** Properties of Trustworthy Encryption Systems.

**Contents:** Modular Arithmetic, Euclidean and Extended Euclidean algorithm,Data Encryption Standard (DES) Algorithm – Overview of the DES Algorithm; Triple DES; Security of the DES; Ad- vanced Encryption Standard (AES), International Data Encryption Standard (IDEA), Cloud Encryp- tion, Blowfish, RC4.

**Self Study:** Cloud Security Risk and Counter Measures

**Further Readings:**RC5

| | | |
|---|---|---|
| **UNIT 3** | **PUBLIC KEY ENCRYPTION** | **08 HOURS** |

**Applications/Case Study:** Case study on Public key cryptography.

**Contents:** An introduction to asymmetric key encryption, Characteristics of Public Key System; RSA Technique, Encryption Fill Algorithm, Boundary Fill Method; Key Exchange; Diffie Hellman Key exchange, Elliptic Curve Cryptography, Quantum Cryptography.

**Self Study:** Post-Quantum Cryptography.

**Further Readings:**Elgamal cryptography.

| | | |
|---|---|---|
| **UNIT 4** | **HASH FUNCTIONS AND DIGITAL SIGNATURE** | **07 HOURS** |

**Applications/Case Study:** Demonstration Digital Certificate Creation.

**Contents:** Hash functions: Authentication requirement, MAC, HMAC, Hash algorithms: Message digest algorithms, SHA algorithms, Digital signature, DSS(Digital Signature Standard). Public key cryptographic standards (PKCS).

**Self Study:** The PKIX model.

**Further Readings:**Implementation of Digital Certificate

| UNIT 5 | EMAIL AND WEB SECURITY | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Case study on security policy

**Contents:** Email Security: SMTP, Mail message formats, Mail access protocols, Pretty good privacy(PGP), Operational description of PGP, S/MIME, S/MIME functionality. Web Security: Se- cure Socket Layer(SSL architecture, Transport Layer Security 1.2(TLS), Secure Electronic Transaction(SET), SET components, SET transaction, JWT (JSON Web Token) Authentication.

**Self Study:** Overview of HTTPS.

**Further Readings:** Cryptographic keys and key rings.

| UNIT 6 | IP SECURITY PRACTICE AND SYSTEM SECURITY | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Demonstration of IP Security and firewall.

**Contents:** IP Security Overview: IPSec architecture, IPSec services, IPSec Applications and benefits, VPN, What is system security, Types of layers and attacks on each layer, Different types of Firewalls, Intrusion Detection.

**Self Study:** DDOS attack

**Further Readings:** Firewall configuration.

## TEXT BOOKS


1. Atul Kahate, *"Cryptography and Network Security",*. 7th The McGraw Hill Publication Third Edition, ISBN – 13: 978-0-07-064823-4.
2. Eric Maiwald, *"Network Security: A Beginners' Guide" ,*.7th ISBN: 978-007-179571-5.


## REFERENCE BOOKS


1. William Stallings, *"Cryptography and Network Security",* . 13th Seventh Edition ISBN-10:1-292-15858-1
2. Behrouz A. Forouzan, *"Introduction to Cryptography and Network Security",* . 13th McGraw-Hill Forouzan Networking Series, ISBN 978–0–07–287022–0.


## E-RESOURCES

1. https://www.cs.vsb.cz/ochodkova/courses/kpb/cryptography-and-network-security *principles – and–practice–7th–global–edition.pdf*

2. *https : //nptel.ac.in/courses/*106105031

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | CRYPTOGRAPHY AND INFORMATION SECURITY LAB |
| | **COURSE CODE** | 2304324L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Number Theory, Computer Networks.

**~~COURSE OBJECTIVES~~ :**

2304324L.CEO.1: To identify basic security attacks and services and the importance of number theory
2304324L.CEO.2: To understand symmetric and asymmetric key algorithms for cryptography
2304324L.CEO.3: To design a security solution for a given application
2304324L.CEO.4: To analyze key management techniques
2304324L.CEO.5: To understand authentication functions and how message authentication codes and hash functions work FOR Firewalls.

**~~COURSE OUTCOMES~~ :**

After successful completion of the course, students Shall be able to,

2304324L.CO.1: Implement cryptography, the CIA triad of information security types.[L3].
2304324L.CO.2: Apply the various encryption mechanisms for secure transmission of data and key management required for encryption.[L3].
2304324L.CO.3: Build digital signature schemes and message authentication techniques.[L3]

**COURSE ABSTRACT:**

This course will deal with the construction and analysis of different security techniques that would prevent any third parties from reading private data between two parties. cryptography has evolved to address the encryption and decryption of user data through the internet and computer systems, It is a branch of cyber and network security

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Write a program to encrypt and decrypt the message using encryption decryption techniques 1. Substitute Method 2. Transposition Method** | **4 HOURS** |
| | | |
| **PRACTICAL NO.02** | **Develop a program in C++/Java/Python on Ad- vanced Extended Euclidean Algorithm.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.03** | **Write a program to implement one of Symmetric Key Cryptography (AES, /DES/ RC4 etc.).** | **4 HOURS** |
| | | |
| **PRACTICAL NO.04** | **Write a program to implement public key cryptogra- phy algorithm RSA.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.05** | **Implement Diffie Hellman key exchange algorithm in client server architecture.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.06** | **Calculate the message digest of a text using the SHA- 1 or MD5 algorithm in JAVA/Python/C++.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.07** | **Create your own digital certiftcate using java key tool** | **2 HOURS** |
| | | |
| **PRACTICAL NO.08** | **Develop a program in .NET,/Python to encode and decode the message for Authentication using HMAC SHA256** | **4 HOURS** |
| | | |

**TEXT BOOKS**


1. Eric Maiwald (2021). *Network Security: A Beginners' Guide*. 13th Edition, ISBN: 978-0-07-179571-5.
2. Atul Kahate (2008),. *Cryptography and Network Security, Tata Mc Grawhill, India.*. 2th Edition, ISBN: 978-0-07-064823-4.


**REFERENCE BOOKS**


1. William Stallings . *Cryptography and Network Security Prentice Hall, Seventh* . 7th Edition, ISBN-10:1-292-15858-1 .
2. Matt Bishop, . *Computer Security Prentice Hall, Seventh* . 1th Edition, Addison-Wesley, 2004


**E-R ESOURCES**

1. IIT Delhi, Virtual lab on Cryptography- https://cse29-iiith.vlabs.ac.in/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | LINUX ADMINISTRATION-I |
| | COURSE CODE | 2304361L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Fundamental of Linux operating system, Operating system

**~~COURSE OBJECTIVES :~~**

2304361L.CEO.1: To configuring, installing, and upgrading Linux systems using established standards and procedures.

2304361L.CEO.2: To understand Redhat Linux operational support.

2304361L.CEO.3: To monitor system performance and availability.

2304361L.CEO.4: Gain sufficient skill to perform core system administration tasks on Red Hat Enterprise Linux

**~~COURSE OUTCOMES :~~**

After successful completion of the course, students will be able to,

2304361L.CO.1: Utilize essential Linux administration tasks [L3]. 2304361L.CO.2: Experiment with installation,networking and user profiles. [L3]. 2304361L.CO.3: Examine physical storage, file systems and log files [L3].

2304361L.CO.4: Inspect the Linux processes,control services,daemons and basic security administration.[L4].

2304361L.CO.5: Analyze Redhat Linux System with a comprehensive and systematic approach [L4].

**COURSE ABSTRACT:**

Red Hat System Administration I. The course provides students with Linux administration "survival skills" by focusing on core administration tasks. Red Hat System Administration I also provides a foundation for students who plan to become full-time Linux system administrators by introducing key command-line concepts and enterprise-level tools. and also to build foundational skills that an RHCSA- certified Red Hat Enterprise Linux system administrator needs.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Introduction to Linux.** | **4 HOURS** |
| **PRACTICAL NO.02** | **Accessing the Command Line: Accessing the Command Line,Accessing the Command Line Using the Desktop,Executing Commands Using the Bash Shell** | **4 HOURS** |
| **PRACTICAL NO.03** | **Managing Files From the Command Line** | **4 HOURS** |
| **PRACTICAL NO.04** | **Getting Help in Red Hat Enterprise Linux.** | **4 HOURS** |
| **PRACTICAL NO.05** | **Create, view, and edit text ftles from command output or in an vim editor Files** | **4 HOURS** |
| **PRACTICAL NO.06** | **Manage local Linux users and groups: Manage local Linux users and groups, and administer local password policies.** | **4 HOURS** |
| **PRACTICAL NO.07** | **Control access to ftles with Linux ftle system permissions: Set Linux ftle system permissions on ftles and interpret the security effects of different permission settings.** | **4 HOURS** |
| **PRACTICAL NO.08** | **Monitor and manage Linux processes: Obtain information about the system, and control processes running on it** | **4 HOURS** |
| **PRACTICAL NO.09** | **Control services and daemons: Control and monitor network services and system daemons using Systemd** | **4 HOURS** |
| **PRACTICAL NO.10** | **Conftgure and secure OpenSSH service: Access and provide access to the command line on remote systems securely using OpenSSH** | **4 HOURS** |
| **PRACTICAL NO.11** | **Analyse and store logs: Locate and accurately interpret relevant system log ftles for troubleshooting purposes.** | **4 HOURS** |
| **PRACTICAL NO.12** | **Manage Red Hat Enterprise Linux networking: Conftgure basic IPv4 networking on Red Hat Enterprise Linux systems** | **4 HOURS** |

| | | |
|---|---|---|
| **PRACTICAL NO.13** | **Archive and copy ftles between systems: Archive ftles and copy them from one system to another. Install and update software packages: Download, install, up- date, and manage software packages from Red Hat and yum package repositories** | **4 HOURS** |
| **PRACTICAL NO.14** | **Access Linux ftle systems: Access and inspect exist- ing ftle systems on a Red Hat Enterprise Linux sys- tem** | **4 HOURS** |
| **PRACTICAL NO.15** | **Analyze Servers and Get Support:Analyze and Man- age Remote Servers,Create a Diagnostics Report, De- tect and Resolve Issues with Red Hat Insights** | **4 HOURS** |

**TEXT BOOKS**

1. Red Hat Enterprise Linux 9.0, "RH124: RED HAT SYSTEM ADMINISTRATION I", Student Guide

**REFERENCE BOOKS**

1. Red Hat Enterprise Linux 8.0, "RH124: RED HAT SYSTEM ADMINISTRATION I", Student Guide

**E-RESOURCES**

1. https://rha.ole.redhat.com/rha/app/courses/rh124

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | WEB TECHNOLOGY |
| | **COURSE CODE** | 2304362L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Database Management System

**COURSE OBJECTIVES :**

2304362L.CEO.1: To Illustrate the concepts and principles of web applications design and development.
2304362L.CEO.2: To introduce scripting language concepts for developing client-side applications.
2304362L.CEO.3: To practice server-side programming features
2304362L.CEO.4: To build responsive web applications.
2304362L.CEO.5: To know the usefulness of web services

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304362L.CO.1: Construct websites using fundamental web languages, technologies and tools [L3].
2304362L.CO.2: To Develop a front-end web application using ReactJS [L3].
2304362L.CO.3: To Construct and configure a backend server using NodeJS and ExpressJS framework [L3].
2304362L.CO.4: To Design a RESTful API for the front-end to access backend services. [L3].

**COURSE ABSTRACT:**

Web Development course syllabus aims to teach about front-end, back-end, and full-stack Web Development. Web Development course covers various topics under Web Development such as Database Management, Web Publishing, Web Design, and Web Programming. Some of the important topics covered in this course include Web Overview and Introduction to Web Development Tools, HyperText Markup Language and Cascading Style Sheets, Introduction to JavaScript, JS Functions and Objects, JavaScript and the DOM, ExpressJs, ReactJs, NodeJs, Moongodb etc. Full stack development using MERN technology.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **HTML, CSS and Frameworks (Bootstrap)** | **10 HOURS** |
| Pre Work: Installation and Configuration of Web Application Servers- Tomcat.<br>1. Design and develop any suitable single page web application using HTML/DHTML, CSS/CSS3 and Framework.<br>•Responsive website design with respect to layouts<br>NOTE : Each student has to create a webpage Example : Amazon.co.in front page etc. | | |
| **PRACTICAL NO.02** | **Javacript** | **10 HOURS** |
| 2. Design and develop any suitable web application to demonstrate the capabilities of Javacript.<br>•Use JSON and Array for storing the data, before saving the data, validate it and show proper error messages.<br>Note : Students have to build web pages for Interactive type applications. Example Calculator, Chat windows etc. | | |
| **PRACTICAL NO.03** | **Front-End JavaScript Frameworks: ReactJS** | **8 HOURS** |
| 3. Design, develop and deploy an web application to demonstrate the client side validation using REACTJS. Note : Students have to do Client-side validation / Interactive type applications. | | |
| **PRACTICAL NO.04** | **Server-side Development: NodeJS** | **8 HOURS** |
| 4. Design, develop and deploy an web application to demonstrate the server side validation using NodeJS.<br>Note : Student will Demonstrate all the capabilities of NodeJS. | | |
| **PRACTICAL NO.05** | **Web Application Framework: ExpressJS** | **6 HOURS** |
| 5. Design, develop and deploy an web application to demonstrate the server side validation using ExpressJS.<br>Note : Student will demonstrate all the capabilities of ExpressJS. | | |

| PRACTICAL NO.06 | RESTful API | 8 HOURS |
|---|---|---|
| 6. Create an API to perform CRUD operation in the database and deploy the application on any web hosting provider and test the API using Postman.<br>Note : Student will demonstrate the building and deploying of API's. | | |
| **PRACTICAL NO. 7** | **NoSQL Database (MongoDB)** | **10 HOURS** |
| 7. Design, develop and deploy an web application to interact with NoSQL database from a Node application.<br>Note : Student will demonstrate the working the NoSQL<br>Self-study Component : Fundamentals of DynamoDB, Fundamentals of Apache Cassandra | | |

**TEXT BOOKS**


1. Ralph Moseley, M.T. Savaliya. *Developing Web Applications.* Willy India,2$^{th}$ Edition, ISBN 9788126538676.
2. Chris Minnick,. *Beginning React JS Foundations Building User Interfaces with ReactJS: An Approachable Guide.* Willy India,1$^{st}$ Edition 2023, ISBN 9781119685630.


**REFERENCE BOOKS**


1. Aleksa Vukotic and James Goodwill. (2021).*Apache Tomcat 7.* Apress.
2. B. M. Harwani, (2010). *Developing Web Applications in PHP and AJAX.* Tata McGraw-Hill.


**E-R ESOURCES**

1. https://www.w3schools.com/
2. https://www.coursera.org/
3. https://getbootstrap.com/
4. https://infyspringboard.onwingspan.com/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | Mobile Application Developement |
| | **COURSE CODE** | 2304363L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Requires knowledge of Course Names without course code

**~~COURSE OBJECTIVES :~~**

2304363L.CEO.1: To apply Java programming concepts to Android app development.
2304363L.CEO.2: To design and develop application for the Android platform 2304363L.CEO.3:
To understand mobile application development using Android Studio

**~~COURSE OUTCOMES :~~**

The students after completion of the course will be able to,

2304363L.CO.1: Install and configure Android application development tools [L3].
2304363L.CO.2: Design and develop User Interfaces for the Android platform [L3].
2304363L.CO.3: Apply SQLite database techniques to store information in persistence storage [L3].
2304363L.CO.4: Construct various Layouts and Widgets in Android Applications [L3].
2304363L.CO.5: Develop and publish mobile app.[L3]

**COURSE ABSTRACT:**

This course is designed to provide with practical hands-on experience in creating, designing, and implementing android applications. Throughout this lab, students will be able to Learn Android Fundamentals, Mastering User Interface Design, Implement Functionality, Utilize APIs and Libraries, Testing and Debugging, Publishing and Distribution. The exciting world of mobile app development that specifically focuses on the Android platform. This lab is structured to equip with the fundamental skills and knowledge required to develop Android applications effectively. This course will provide a solid foundation in the development of Android applications, as Android being one of the most popular mobile operating systems worldwide, offers vast opportunities for developers to create innovative and impactful applications that can reach millions of users globally.

GUIDELINES FOR CONDUCTION OF LAB

1. Course Teacher or Lab Instructor may frame the assignments/mini-project by understanding the prerequisites, technological aspects, utility and recent trends related to the respective courses.
2. According to assigned number of hours, course instructor has to decide minimum number of practical assignments.
**3:** Preferably there should be multiple sets of assignments/mini-project and distribute among batches of students.

CONTENTS

- Basic building blocks of Android with example
- Android Layouts and UI composition
- Database SQLite, Shared Preferences and Files
- Notifications
- Location Service and Maps
- Creating distributable APK and Publishing

| PRACTICAL | | |
|---|---|---|
| **PRACTICAL NO.01** | **Installation of Android Studio and Introduction of Android** | **4 HOURS** |
| a. Installing all required software's for android development and emulator | | |
| **PRACTICAL NO.02** | **Basic building blocks of Android with example** | **6 HOURS** |
| a. Understanding all basic building blocks of Android [activities, views, intents, etc.<br>b. Assignment based on Activity and Intents<br>c. Assignment based on android service | | |
| **PRACTICAL NO.03** | **Android Layouts and UI composition** | **8 HOURS** |
| a. Assignment based on Linear and Constraint Layout.<br>b. Assignment based on List View<br>c. Assignment based on Relative, Frame and Grid Layout | | |
| **PRACTICAL NO.04** | **Database SQLite, Shared Preferences and Files** | **8 HOURS** |
| a. Assignment based on saving some string data in Shared Preference<br>b. Assignment based on saving files in mobiles<br>c. Assignment based on connecting with SQLite performs CRUD.<br>d. Assignment based on accessing public folders of android. | | |
| **PRACTICAL NO.05** | **Notiftcations** | **6 HOURS** |
| a. Assignment based on Broadcast Receivers<br>b. Assignment based on Services and notifications<br>c. Assignment based on Toast | | |
| **PRACTICAL NO.06** | **Firebase** | **8 HOURS** |
| a. Assignment based on adding firebase to project<br>b. Assignment based on firebase cloud messaging<br>c. Assignment based on data push | | |
| **PRACTICAL NO.07** | **Location Service and Maps** | **8 HOURS** |
| a. Assignment based on fetching device location using GPS<br>b. Assignment based on loading google map in application<br>c. Assignment based on showing device location on map<br>d. Assignment based on geocoding. | | |
| **PRACTICAL NO.08** | **Creating distributable APK and Publishing** | **12 HOURS** |
| a. Assignment on creating APK with all required security concern<br>b. Assignment based on publishing app on Play Store. | | |

**TEXT BOOKS**


1. Barry Burd. (2015). *Android Application Development All-in-One For Dummies*. Wiley Brand, ISBN: 978-8126557943
2. Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti (2011). *Android SDK 3 for Dummies*. Wiley, ISBN: 9781118008256
3. Zigurd Mednicks, Laird Dornin, G. Blake Meike, Masumi Nakamura (2012). *Programming An- droid*. O'Reilly Media Inc.ISBN: 9781449316648.


**REFERENCE BOOKS**


1. Dawn Griffiths, David Griffiths (2021). *Head First Android Development: A Learner's Guide to Building Android Apps with Kotlin*, O'Reilly Media.
2. Michael Burton (2015). *Android App Development For Dummies*, Wiley. ISBN: 978-8126557868
3. Meier Reto (2012). *Professional Android 2 Application Development*, Wiley India, ISBN: 9788126525898.
4. Marko Gargenta, Masumi Nakamur (2014). *Professional Learning Android: Develop Mobile Apps Using Java and Eclipse*, O'Reilly Media, Inc. ISBN: 9781449336257.
5. Lombardo John, Rogers Rick: Mednieks Zigurd (2010). *Android Application Development*, Shroff Publishers, ISBN: 9788184047332


**E-R ESOURCES**

1. Official android doc : https://developer.android.com/docs

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | UI/UX DESIGN |
| | COURSE CODE | 2304364L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE KNOWLEDGE :**

**~~COURSE OBJECTIVES :~~**

2304364L.CEO.1: To apply the foundations of Human Computer Interaction.
2304364L.CEO.2: To Understand the design technologies for individuals and persons with disabilities.
2304364L.CEO.3: To apply the guidelines, principles and standards for user interface design.

**~~COURSE OUTCOMES :~~**

After successful completion of the course, students will be able to,

2304364L.CO.1: Identify human factors and usability issues related with computing applications. [L2].
2304364L.CO.2: Apply suitable design principles, models and usability guidelines for user interface design [L3].
2304364L.CO.3: Demonstrate the impact of usability evaluation and testing in computing applications [L2].
2304364L.CO.4: Design user interfaces using required processes and standards.[L6].

**COURSE ABSTRACT:**

UI/UX, which stands for User Interface/User Experience, is a course that focuses on creating intuitive, visually appealing, and user-friendly digital products and experiences. It combines principles from various disciplines such as design, human psychology,ergonomics and technology to enhance usersatisfaction and engagement.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Understanding Human Factors – Input Output Channels , Memory, Thinking, Emotions, Ergonomics. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Identifying Faulty Designs, Miller's Principle, Models of interactions- Norman's Action Model, Gulf of Execution and Evaluation, Errors – Mistakes, Slips, Lapses and Violations, | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Understanding Design Process, Iterative Design, Navigation Design, Colors, Metaphors, Interaction Styles | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| UI design and elements current UI design patterns style guides and design systems material design and other design systems. | | |
| **PRACTICAL NO.05** | | **4 HOURS** |
| Identify specialized users and related facilities for a selected product or system and make necessary suggestions for its improved accessibility design. | | |
| **PRACTICAL NO.06** | | **4 HOURS** |
| Empathizing through Enquiry model to collect and listing of User and UX Requirements. | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Design user persona for the users of selected product or system. | | |
| **PRACTICAL NO.08** | | **4 HOURS** |
| Conduct a contextual inquiry for selected product or system. | | |
| **PRACTICAL NO.09** | | **4 HOURS** |
| Design an interface prototype for selected product or system. | | |
| **PRACTICAL NO.10** | | **4 HOURS** |
| Design an interface prototype for selected product or system (GOMS, GOEE). | | |

| | | |
|---|---|---|
| **PRACTICAL NO.11** | | **4 HOURS** |
| Design an interface prototype for selected product or system after Peer Expert Review 1. | | |
| **PRACTICAL NO.12** | | **4 HOURS** |
| Evaluate an interface using usability evaluation technique. | | |
| **PRACTICAL NO.13** | | **4 HOURS** |
| Evaluate an interface using usability evaluation technique. | | |
| **PRACTICAL NO.14** | | **4 HOURS** |
| Expert Evaluation – Cognitive walk through and User Based Evaluation | | |
| **PRACTICAL NO.15** | | **4 HOURS** |
| Demonstration and Justification of UI/UX Design (Conclusion) | | |

**TEXT BOOKS**

1. Alan Dix, Janet Finlay. (2004). *Human Computer Interaction*. 3rd Edition, Pearson publication ISBN 978-8131717035.

**REFERENCE BOOKS**

1. Ben Shneiderman. *Designing the User Interface*. 3rd Edition, Pearson publication . ISBN 978-8131721636.

**E-R ESOURCES**

1. https://nptel.ac.in/courses/106106177

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Major Project - I |
| | COURSE CODE | 2304391L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304391.CEO.1: To equip students with the ability to conduct thorough literature reviews, identifying relevant academic and industry sources.

2304391.CEO.2: To introduce fundamental design principles and methodologies applicable to engineering and technology projects.

2304391.CEO.3: To teach students the basics of creating models/designs to represent systems with modelling tools and software commonly used in industry and research.

2304391.CEO.4: To understand how simulation tool can be used for iterative design improvement and optimization.

2304391.CEO.5: To guide students how to communicate their project findings clearly and concisely through written reports.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304391.CO.1: Apply mathematical, scientific, and engineering principles in the design and development of their projects [L3].

2304391.CO.2: Analyze, and solve complex engineering problems, demonstrating proficiency in research methodologies and modern tools [L4].

2304391.CO.3: Assess the societal and environmental impacts of their engineering solutions and incorporate ethical considerations into their projects [L5].

2304391.CO.4: Communicate their project ideas and results effectively through presentations and reports, and work collaboratively in teams [L3].

2304391.CO.5: Apply effective project management skills, including planning, resource allocation, and adherence to timelines, while engaging in continuous learning and improvement [L3].

**COURSE ABSTRACT:**

The project is most important part of undergraduate curriculum and enables student's to develop an- alytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Project Design, Project Implementation and Project Evaluation. The first phase of Project Design mainly focuses on formulating system's requirement, background/literature review, and defining scope, objective and apply project management/modeling tools to design proposed solution. This enables students to apply their technical acumen and innova- tiveness in proposing methodology, milestones, and

**GUIDELINES**

1. Every project group should consist of minimum 03 and maximum of 04 students.
2. The group members may be from different programs to support the interdisciplinary functioning.
3. Project group members and title of the project need to be approved by Project Guide and School.
4. Projects should preferably have a national/international industry/academic/research collabora- tion.
5. User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
6. The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.
7. Define proposed solution and apply project management/modeling tools for project planning and design.
8. Critically analyze various solutions/techniques to solve real world problems and perform feasibility study to select and justify proposed solution.
9. Define outcome, milestones, definite roadmap for project design, implementation, evaluation and documentation.

**Collaborative/Sponsored Project**

1. Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for project work.
2. Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization, anytime before the commencement of the sixth semester.
3. Proposed Collaborative Project work need to reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of minimum 12 months to 18 months.
4. Final assessment will be carried out in presence of faculty mentor, external mentor and

**TIMELINE**

1. Exploration of fore front research/specialization areas and opportunities in the various fields.
2. Formation of Project Group. Finalization of area of work/title as per forefront areas.
3. Exploration of abridged courses, valid resources, challenges, relevance with current opportunities.
4. Background study Systematic literature review.
5. Literature review documentation for Project Report and Research Article.
6. Project Review I Presentation.
7. Define problem statement and objectives.
8. Define scope of the work and Outline of the work.
9. Project Design, Modelling, Simulation etc.
10. Proposed Methodology of the solution and its documentation.
11. Project Review II Presentation.
12. Project Documentation: Ethics in Writing
13. Project Documentation: Final Synopsis
14. Project Documentation: Project Report Writing

**ASSESSMENT and EVALUATION**

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Background Study and Literature Review (10 Marks)
2. Synopsis (5 Marks)
3. Project Review I: Problem Identification, Motivation, Relevance, Background Study, Literature Review (10 Marks)
4. Project Review II: Literature Review, Problem Definition, Project Planning, Analysis and Design (10 Marks)
5. Project Report (10 Marks)
6. Final Presentation and Demonstration (30 Marks)

**TEXT BOOKS**


1. John M. Nicholas. (2012). *Project Management for Engineering, Business and Technology*. 4th Edition, Butterworth-Heinemann. ISBN 978-0080967042.
2. Leslie Lamport. (1994). LaTeX: *A document preparation system, User's guide and reference manual*. 2nd Edition, Addison-Wesley. ISBN 978-0201529838.


**REFERENCE BOOKS**


1. Michelle Reid. (2018). *Report Writing (Pocket Study Skills)*. 2nd Edition, Bloomsbury Publish- ing. ISBN 978-0230376557.
2. Sara Efrat Efron and Ruth David. (2018). *Writing the Literature Review : A Practical Guide*. 1st Edition, Guilford Press . ISBN 978-1462536894 .


**E-R ESOURCES**

1. IEEE Open Access Articles
2. Science Direct Open Access E-Journals
3. ASME Digital Collections
4. ASCE (American Society for Civil Engineers)
5. CSIR-NISCAIR E- journals
6. Spriger Open Access E-Journals & E-Journals
7. Shodh Gangotri (Repository of Indian Research in Progress)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEEREING | COURSE NAME | Internship (Technical) |
| | COURSE CODE | 2304396L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | NIL | 75 | 75 |

**PRE-REQUISITE :** Knowledge about the communication skills

**COURSE OBJECTIVES :**

2304396.CEO.1: To enhance technical skills and self-directed learning.
2304396.CEO.2: To develop adaptability and resilience in a multicultural or professional environment.
2304396.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.
2304396.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.
2304396.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304396.CO.1: Apply technical competencies gained through hands-on training or certification programs to solve discipline-specific engineering problems [L3].

2304396.CO.2: Develop professional behavior by demonstrating teamwork, time management, and eth- ical practices in technical and industrial environments [L5].

2304396.CO.3: Evaluate personal and professional growth through critical analysis of experiential learning and industry training outcomes to support career planning [L5].

2304396.CO.4: Formulate strategies addressing emerging industry needs by integrating advanced technical skills with real-world insights [L4].

2304396.CO.5: Propose solution-oriented approaches to complex problems using multidisciplinary knowledge and practical exposure [L5].

2304396.CO.6: Design and deliver technical presentations and detailed reports that effectively commu-

**INTRODUCTION:**

This internship is designed to equip third year entrants B.Tech. students with essential skills for personal and professional growth. The program emphasizes cultivating professionalism, technical expertise, and real-world problem-solving capabilities, enabling students to thrive in competitive and dynamic landscape. Through this immersive experience, students will develop a comprehensive skill set that includes technical knowledge applied through real-time projects, effective communication, teamwork, and adaptability.

A significant focus of the program is encouraging students to pursue technical certifications in core and emerging domains, thereby enhancing their technical competence and industry readiness. These certifications include, but are not limited to:

- **Programming and Development:** Java, Python, C++, and Advanced Java.
- **Database Management:** Oracle, SQL, and MongoDB.
- **Engineering Design and Simulation:** Autodesk Revit, MATLAB, ANSYS, and AutoCAD.
- **Process Simulation and Optimization:** Aspen HYSYS, Aspen Plus, and CFD (Computa- tional Fluid Dynamics).
- **Data Analytics and Visualization:** Power BI, Tableau, and Excel Advanced Analytics.
- **Cloud Computing and Automation:** AWS (Amazon Web Services), Microsoft Azure, and DevOps Essentials.
- **AI and Machine Learning:** TensorFlow, PyTorch, and introductory courses in AI/ML appli- cations.
- **Digital Tools for Productivity:** Primavera P6 for project management and SolidWorks for design engineering.

By participating in this internship, students will gain hands-on experience in their chosen technical areas, actively apply theoretical knowledge to practical challenges, and build confidence in delivering solutions. The program also emphasizes collaboration and peer learning, helping students to develop essential teamwork skills.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the third year of the B.Tech. program, to be undertaken during the summer break after Semester IV. This program aims to provide opportunities for skill enhancement through global certifications, technical skills training, or industrial exposure. The internship focuses on helping students identify and engage with relevant learning platforms, small-scale industries, or training opportunities to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

- **Duration:** : 3 to 4 weeks (minimum of 100 hours).
- **Timeframe:** Conducted during June-July of each academic year.
- **Nature of Internship:**

1. Technical skills training programs.
2. Industrial training with companies or small-scale industries.
3. Certifications in core technical fields such as programming, database management, design, simulation, and data analysis.

- **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.
- **Mentorship:** Each second-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development. **Student Development Focus :**

Before selecting an internship option, second-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. The program places significant emphasis on pursuing technical certification programs in areas such as programming, database management, engineering design, simulation, data analytics, and more. These certifications will enhance students' technical expertise and provide them with a competitive edge in the industry, preparing them for future academic and career success.

Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

**1. Continuous Assessment (CA): Biweekly Progress Reports and interaction with faculty mentor (40%):**

Students must submit at least two progress reports during the internship/training period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them

**2. Detailed Project Report with Learning Outcomes (30%)**

Upon completion of the internship, students are required to submit a comprehensive minimum of 20 to 25 pages' internship/project report. The report must include:

1. Overview of the Industry/Research Institute
2. Skills and knowledge acquired (technical/soft/life)
3. Specific challenges addressed
4. Personal and professional growth reflections
5. Clearly stated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certiftcate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | SOFTWARE ENGINEERING |
| | **COURSE CODE** | 2304313T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Prototyping

**COURSE OBJECTIVES :**

2304313T.CEO.1: To explore the software process models.
2304313T.CEO.2: To process requirement engineering and modeling for product development.
2304313T.CEO.3: To estimate and manage software metrics.
2304313T.CEO.4: To understand the test driven environment in software development.
2304313T.CEO.5: To illustrate DevOps lifecycle and different tools

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304313T.CO.1: Classify SDLC process models.[L4]
2304313T.CO.2: Analyze conformance of the requirement and modeling related to project development.[L4]
2304313T.CO.3: Apply mitigation techniques for the risk associated with project development.[L3]
2304313T.CO.4: Evaluate the schedule, cost and staff associated with project. [L5]
2304313T.CO.5: Apply different DevOps tools for project development. [L3]

**COURSE ABSTRACT:**

The Software Engineering course provide preparation for careers in system development, project management, and quality assurance with cutting-edge tools and methodologies. Enhance technical skills and problem-solving abilities essential for top tech roles.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Basics of Software Engineering** | **08 HOURS** |

**Applications/Case Study:** Learning Game Design and Software Engineering through a Game Prototyping Experience

**Contents:** Generic process model: Process framework, umbrella activities, Process Adaptation, Perspective Process Models - Waterfall Model, Prototyping, Incremental, and Agile Process Model: XP and Scrum, introduction to Principles of framework Activities, DevOps concepts and process

**Self Study:** Component based development process model.

**Further Readings:** Dynamic System Development Method.

| | | |
|---|---|---|
| **UNIT 2** | **Requirement Analysis and Modelling** | **09 HOURS** |

**Applications/Case Study:** Online Marketing Software Platform

**Contents:** Requirement Engineering, Scenario based requirement modeling, Class based requirement modeling, Behavior based requirement modeling, Requirement modeling for web and mobile apps, Design Concepts, Design models, Architectural design, Static and Dynamic UML Diagrams: Class diagram, Object diagram, Use case, Activity diagram, Sequence diagram, Block diagram, Architectural diagram and Deployment diagram

**Self Study:**Interaction Model for Web and Mobile Apps

**Further Readings:**Configuration Models for Web Apps.

| | | |
|---|---|---|
| **UNIT 3** | **Process Management and Estimation** | **08 HOURS** |

**Applications/Case Study:** Successful Application of Software Reliability by Norman F. Chnei- dewind

**Contents:** Software Configuration Management, Software Project Planning: Project Planning objec- tives, Software Metrics: Size, Function Point, Staffing, Project Estimation Methods Decomposition Techniques, Empirical Estimation Models COCOMO Model, Risk Management: Risk Identification, Analysis, mitigation methods

**Self Study:** Software Quality ISO Standards

**Further Readings:**ISO/IEC 9126 Software engineering

| | | |
|---|---|---|
| **UNIT 4** | **Test Driven Development** | **08 HOURS** |

**Applications/Case Study:** Manual Testing (Online Marketing Software Platform)

**Contents:** System Testing - System Integration Techniques - Incremental, Top-Down Bottom, White box Testing, Black box Testing, Performance Testing, Security Testing, Acceptance testing

**Self Study:** Automated Testing life cycle

**Further Readings:**Software Reliability

| UNIT 5 | DevOps and Automation | 12 HOURS |
|---|---|---|

**Applications/Case Study:** Maven and Puppet

**Contents:**Introduction to DevOps life cycle, DevOps tools, Version Control System, GIT, Continuous Integration, Jenkin, Containerizing the applications, Docker life cycle, Docker commands, Kubernetes components, Kubernetes master slave architecture, Namespace, Application deployment in kubernetes cluster, Configuration management, Ansible architecture, Setting up master slave using ansible, Ansible playbook, Roles, Configurations using ansible, continuous monitoring, Nagios, Nagios Architecture, Nagios commands, Nagios plugins, Nagios notification

**Self Study:** GCP Cloud Computing and Storage in DevOps

**Further Readings:** Appdynamics

**TEXT BOOKS**


1. Roger Pressman(2023), *"Software Engineering: A Practitioner's Approach"*, McGraw-Hill Education; . 9th Edition, ISBN 13: 978-9355325044
2. Ian Somerville (2018), *"Software Engineering"* Pearson Publication; 9th edition, ISBN-13: 978-0-13- 703515-1
3. Srinivasan Desikan (2007),*" Software Testing Principals and practices"*, Pearson Publication, ISBN-13 978- 8-17-758295-6


**REFERENCE BOOKS**


1. Kshirasagar Nak, Priyadarshi Tripathy(2008), *"Software Testing and Quality Assurance-Theory and Practice "*, John Wiley Sons Inc
2. Jeff Tian, John Wiley(2005) *"Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement "*, Jeff Tian, John Wiley Sons, Inc., Hoboken, New Jersey.


**E-R ESOURCES**

1. https://nptel.ac.in/courses/106105182

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | SOFTWARE ENGINEERING LAB |
| | COURSE CODE | 2304313L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :**

Prototyping

**~~COURSE OBJECTIVES :~~**

2304313L.CEO.1: To explore the software process model.
2304313L.CEO.2: To process requirement engineering and modeling for product development.
2304313L.CEO.3: To estimate and manage software metrics.
2304313L.CEO.4: To understand the test driven environment in software development. 2304313L.CEO.5: To illustrate DevOps lifecycle and different tools.

**~~COURSE OUTCOMES :~~**

After successful completion of the course, students will be able to,

2304313L.CO.1: Analyze conformance of the requirement and modeling related to project development.[L4]
2304313L.CO.2: Apply mitigation techniques for the risk associated with project development. [L3]
2304313L.CO.3: Demonstrate the usage of tools for project development phases. [L3]

**~~COURSE ABSTRACT:~~**

The Software Engineering course provide preparation for careers in system development, project management, and quality assurance with cutting-edge tools and methodologies. Enhance technical skills and problem-solving abilities essential for top tech roles.

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **A. Students are required to take a real-life scenario for software development (ERP, Mobile app, IoT project) and apply a correct Development paradigm for it with justiftcation.**<br><br>**OR**<br><br>**Students can take mini or minor project/ DBMS project / DSF Project and explain which software development paradigm was used, what were the lim- itations of that paradigm. Students should propose a revised paradigm to overcome the limitations of ex- isting one with justiftcation.**<br>**B. For the project, make a SRS in IEEE format.** | **6 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.02** | **Take your problem statement and design modelling using UML Diagrams.** | **4 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.03** | **Prepare a suitable cost estimation model, WBS, Gantt chart (using MS project tool) and all neces- sary estimation for your project.** | **4 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.04** | **Prepare the risk mitigation plan for the selected project.** | **4 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.05** | **Design test driven process for project based on asso- ciated risk and possible threats.** | **4 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.06** | **Use and demonstration of any two Devops tools for the project.** | **4 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.07** | **Final presentation: Report and PPT** | **4 HOURS** |
| Further practice: NIL | | |

**TEXT BOOKS**


1. Joakim Verona (2016), *Practical DevOps* , Packt Publishing Limited, 1$^{ed}$ Edition,O'Reilly Media Inc, ISBN-13 978-9352133765
2. Jennifer Davis Ryn Daniels, (2017) *Jenkins Essentials*. 2$^{ed}$ edition, Packt Publishing Limited, ISBN-13 978-1783553471


**REFERENCE BOOKS**


1. Mitesh Soni (2017). *Jenkins Essentials*. 2$^{ed}$ Edition , Packt Publishing Limited, ISBN-13 978-1783553471


**E-RESOURCES**

1. https://nptel.ac.in/courses/106105182

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | DESIGN AND ANALYSIS OF ALGORITHMS |
| | **COURSE CODE** | 2304314T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :**

Calculus and differential equation, Foundation of Computing

**COURSE OBJECTIVES :**

2304314T.CEO.1: To develop problem solving abilities using mathematical theories. 2304314T.CEO.2: To apply algorithmic strategies while solving problems.
2304314T.CEO.3: To analyze performance of different algorithmic strategies in terms of time.
2304314T.CEO.4: To distinguish between P and NP class of problems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304314T.CO.1: Analyze the given algorithm in terms of its computational complexity. [L4].
2304314T.CO.2: Apply algorithmic strategies to solve given problems. [L3].
2304314T.CO.3: Find optimal solution by applying various methods. [L3].
2304314T.CO.4: Solve intractable problem by using approximation algorithm. [L3].
2304314T.CO.5: Make use of string matching algorithm to find matches between specified pattern. [L3]

**COURSE ABSTRACT:**

This course introduces the mathematical notion of algorithms and teaches how to develop, validate, and optimize them for performance and memory. The course includes a significant mathematics component, as well as the design of various algorithms.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION OF ALGORITHMIC STRATEGY** | **08 HOURS** |

**Applications/Case Study:** Packet switched network, Binary Search.

**Contents:** Algorithm, performance analysis, Need of Algorithm,Asymptotic Notation, Problem solving strategies Divide and Conquer: Basic method, Example: Quick Sort, Max-Min Problem, Large integer multiplication algorithm, Recurrence: Substitution method, Master Theorem.

**Self Study:** Median of Two sorted arrays of same size.

**Further Readings:** Strassen's Matrix Multiplication.

| | | |
|---|---|---|
| **UNIT 2** | **GREEDY METHOD** | **06 HOURS** |

**Applications/Case Study:** CPU Scheduling Algorithms, Network Routing

**Contents:** Greedy Algorithm: Basic Method and Algorithms, Example: Fractional Knapsack Problem, Job Sequencing with Deadline, Huffman Algorithm, Activity Selection Problem.

**Self Study:**Coin Changing Problem

**Further Readings:**Task scheduling problem as a matroid.

| | | |
|---|---|---|
| **UNIT 3** | **DYNAMIC PROGRAMMING** | **08 HOURS** |

**Applications/Case Study:** Google Map, Google search engine

**Contents:** Dynamic Programming: Basic Method, Example: 0/1 Knapsack, Chain Matrix Multipli- cation OBST, All pairs shortest path, Floyd-Warshall's Algorithm, Travelling Salesman Problem.

**Self Study:** Coin changing problem.

**Further Readings:**Longest common Subsequence Problem.Single source shortest path: Bellman Ford algorithm.

| | | |
|---|---|---|
| **UNIT 4** | **BACKTRACKING AND BRANCH AND BOUND** | **08 HOURS** |

**Applications/Case Study:** Parser, Crossword puzzle, Sudoku.

**Contents:** Backtracking: Basic Method, Examples: Eight Queen Problem, Sum of Subset prob- lem,Branch and Bound: Basic Method, FIFO and LC approach, 0/1 knapsack problem using FIFO LC Approach, Traveling Salesperson problem FIFO LC Approach

**Self Study:** Backtracking Algorithms for Enumerating Independent Sets of a Graph.

**Further Readings:**15 Puzzle problem.

| UNIT 5 | COMPUTATIONAL COMPLEXITY THEORY | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Airline crew scheduling, TSP and Graph coloring problem.

**Contents:** Classifying Problems, Nondeterministic Deterministic problems, Tractable Non Tractable problems, Reductions, Cook's Theorem, NP-Complete problem, NP-Hard problem,3SAT Problem Approximation algorithm: vertex cover problem.

**Self Study:** Approximation algorithm for TSP.

**Further Readings:** Clique Decision problem.

| UNIT 6 | ADVANCED ALGORITHMS AND APPLICATIONS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** plagiarism detector, spell checker, web search engines

**Contents:** Randomized algorithms : Monte Carlo and Las Vegas algorithm, String matching algo- rithm: KMP, Boyer Moore Algorithm, Robin Karp Algorithm, Number theoretic algorithm: : the GCD – Modular Arithmetic – The Chinese Remainder Theorem.

**Self Study:** Na¨ıve string matching algorithm.

**Further Readings:** The general string problem as a finite automata.

## TEXT BOOKS


1. E.Horowitz , S. Sahni, S. Rajasekaran (2008) *Fundamentals of Computer Algorithms*. 2nd Edition, Universities Press pvt Ltd ,ISBN 9788173716126.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein (2022) *Introduction to Algorithm*. 4th edition. Cambridge. Massachusetts : The MIT Press. ISBN 9780262367509.
3. Anany Levitin *Introduction to the Design and Analysis of Algorithms*. 3rd edition,ISBN: 9780132316811.


## REFERENCE BOOKS


1. V. Aho, J.D. Ullman,(2002)*Design and Analysis of Computer Algorithms*. 1st Edition, Pearson Education , ISBN 8131702057 PHI Learning Pvt Ltd, 2011, ISBN 978-81-203-40007-7.
2. Brassard G. and Bratley P.*Algorithms, Theory and Practices*. 1st Edition , PHI. ISBN 0-13-023243-2.


## E-R ESOURCES

1. https://nptel.ac.in/courses/106101060

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | DESIGN AND ANALYSIS OF ALGORITHMS LAB |
| | COURSE CODE | 2304314L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :**

Calculus and differential equation, Foundation of Computing

**COURSE OBJECTIVES :**

2304314L.CEO.1: To design an efficient algorithm for any specified problem.

2304314L.CEO.2: To carry out the analysis of various algorithms in terms of its computational complexity.

2304314L.CEO.3: To identify appropriate algorithmic design strategies to optimize the performance of a given problem.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304314L.CO.1: Design algorithms using appropriate design Techniques [L3]. 2304314L.CO.2: Implement a variety of algorithms in a high level language. [L3]

2304314L.CO.3: Apply and implement learned algorithm design techniques to solve real-world problems.[L3].

2304314L.CO.4: Analyze algorithms to deduce their time complexities. [L5].

**COURSE ABSTRACT:**

This course introduces the mathematical notion of algorithms and teaches how to develop, validate, and optimize them for performance and memory. The course includes a significant mathematics component, as well as the design of various algorithms.

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **Design and implement various application of divide and conquer approach.** | **4 HOURS** |
| Further practice: Strassen's Matrix Multiplication | | |
| **PRACTICAL NO.02** | **write a program to solve application using Greedy Approach. Calculate the time complexity of the algorithm.** | **4 HOURS** |
| Further practice: NIL | | |
| **PRACTICAL NO.03** | **Design and implement problem using dynamic approach.Calculate the time complexity of the algo- rithm.** | **6 HOURS** |
| Further practice: Coin Changing | | |
| **PRACTICAL NO.04** | **Write a program to solve application of branch and bound approach.** | **4 HOURS** |
| Further practice: Sum of Subset | | |
| **PRACTICAL NO.05** | **Design and Implement application based on backtracking approach.** | **4 HOURS** |
| Further practice: Graph coloring | | |
| **PRACTICAL NO.06** | **Design and Implement the string matching algo- rithm.** | **4 HOURS** |
| Further practice: Rabin Karp | | |
| **PRACTICAL NO.07** | **Design and Implement randomized algorithms.** | **4 HOURS** |
| Further practice: Quick Sort | | |

**TEXT BOOKS**


1. E.Horowitz , S. Sahni, S. Rajasekaran (2008). *Fundamentals of Computer Algorithms*. 2nd Edition, Universities Press pvt Ltd , ISBN 9788173716126.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein (2022) *Introduction to Algorithm*. 4th edition, Cambridge, Massachusetts : The MIT Press, ISBN 9780262367509.


**REFERENCE BOOKS**


1. V. Aho , J.D. Ullman (2002). *Design and Analysis of Computer Algorithms*. 1st Edition , Pearson Education 2002, ISBN 8131702057 PHI Learning Pvt Ltd, 2011, ISBN 978-81-203-40007-7.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | PREDICTIVE ANALYTICS |
| | COURSE CODE | 2304326T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Descriptive Analytics

**COURSE OBJECTIVES :**

2304326T.CEO.1: To summarize the Supervised Learning Methods. 2304326T.CEO.2: To understand the advanced classification techniques. 2304326T.CEO.3: To explain Artificial Neural Network.
2304326T.CEO.4: To understand Clustering Techniques.
2304326T.CEO.5: To understand Deep learning and Natural Language Processing.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304326T.CO.1: Apply the classification and prediction techniques to solve real world problems[L3[.
2304326T.CO.2: Use advanced classification techniques[L3].
2304326T.CO.3: Apply artificial neural network (ANN) for implementing Deep Learning models[L3].
2304326T.CO.4: Implement different clustering techniques[L3[.
2304326T.CO.5: Implement different ensemble learning techniques[L3].
2304326T.CO.6: Solve real world problems using deep learning models and NLP.[L3]

**COURSE ABSTRACT:**

Predictive analytics is a powerful field that leverages data science to make informed decisions, antici- pate future trends, and optimize strategies across various domains. This comprehensive course delves into advanced predictive analytics methodologies, equipping participants with the knowledge and skills necessary to extract actionable insights from data.Throughout the course, participants will explore cutting-edge techniques including advanced classification, artificial neural networks (ANNs), deep neu- ral networks (DNNs), Ensemble Learning methods, clustering techniques, and ensemble techniques.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **CLASSIFICATION AND PREDICTIONS** | **08 HOURS** |

**Applications/Case Study:** House price prediction Case

**Contents:** Classification and Prediction, Decision Tree-Based Classification-(c.4.5), Probabilistic Classification: Naive Bays Classification, Bayesian Belief Network (BBN), Eager Learning, Lazy Learning, K-Nearest neighbor- KNN. Support Vector Machine (SVM), Soft Versus Hard Margin, Local and Global Minima,

**Self Study:** Classification Assessment

**Further Readings:** A fast Scalable Classifier for Data mining

| | | |
|---|---|---|
| **UNIT 2** | **CLUSTERING TECHNIQUES** | **06 HOURS** |

**Applications/Case Study:** Online Shopping Case Study

**Contents:** Basics of Clustering, Quality Parameters of Clustering, Various Clustering Approaches. Partitioning Methods: K-Means, K-Medoids (Partition Around Medoids), Hierarchical Methods: Agglomerative and Divisible Clustering. Expectation Maximiza- tion (EM) Algorithm, Discussion On EM.

**Self Study:** Spectral Clustering.

**Further Readings:** Graph Clustering.

| | | |
|---|---|---|
| **UNIT 3** | **ARTIFICIAL NEURAL NETWORK** | **08 HOURS** |

**Applications/Case Study:** Automatic car Case Study

**Contents:** Artificial Neural Network (ANN): Neurons, perceptron, parameter settings of ANN, Topologies of ANN, transfer functions, learnings in ANN, Activation functions, Learning rate, Gradient descent, Back- Propagation, Basic forms of Neural processing, Advantages and Limitations of ANN. Introduction to deep learning , Deep learning models.

**Self Study:** Convolutional Neural Networks.

**Further Readings:** Deep Architecture.

| UNIT 4 | NATURAL LANGUAGE PROCESSING (NLP) | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Social media Anallytics

**Contents:** NLP Introduction, Part of S Tagging, Part Of Speech tagging approaches: HMM for POS. A large language model (LLM) introduction, Training and working of LLM. Applications of LLM using case study.

**Self Study:** NLP- Stop word removal, Stemming, lemmatization,topic modeling

**Further Readings:** Fine tuning of LLM

| UNIT 5 | DEEP LEARNING | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Disease Classification Using CNN.

**Contents:** CNN architecture overview, The Basic Structure of a Convolutional Network- Padding, Strides, Typical Settings, the ReLU layer, Pooling, Fully Connected Layers, Training a Convolutional Network. Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder, The Challenge of Long- Term Dependencies, The Long Short-Term Memory. Design neural network architectures for new data problems based on their requirements and problem characteristics, and analyze their performance.

**Self Study:** Long Short-Term Memory Networks (LSTMs)

**Further Readings:** Fine Tuning RNN Models

| UNIT 6 | GENERATIVE ADVERSARIAL NETWORKS | 07 HOURS |
|---|---|---|

**Applications/Case Study:** FaceAPP

**Contents:** Introduction to Generative Models, working principle of GAN, Role of the discriminator, generator, Mode Collapse and Problems with BCE Loss , Training vs. Inference, Earth Mover's Dis- tance (Wasserstein Distance), Wasserstein-Loss, Condition on W-loss Critic, 1-Lipschitz Continuity Enforcement..

**Self Study:** DCGANs

**Further Readings:** CycleGAN for image translation

**TEXT BOOKS**


1. Murrey R Spiegal, Larry Stifens, "Statistics" , 5th edition ,Schaum's Series, McGraw-Hill Edu- cation; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527
2. Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.
3. Alpaydin, E. (2010). Introduction to Machine Learning. MIT Press.
4. François Chollet, Deep Learning with Python, Manning Publications.
5. Stefano van der Walt and Sharon Zhou, Hands-On Generative Adversarial Networks with PyTorch 1.x: Implement next-generation neural networks to build powerful GAN models using Python, Packt Publishing

**REFERENCE BOOKS**


1. Murrey R Spiegal, Larry Stifens, "Statistics" , 5th edition ,Schaum's Series, McGraw-Hill Edu- cation; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527
2. Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.
3. Alpaydin, E. (2010). Introduction to Machine Learning. MIT Press.
4. Francois Chollet, Deep Learning with Python, Manning Publications.
5. Stefano van der Walt and Sharon Zhou, Hands-On Generative Adversarial Networks with PyTorch 1.x: Implement next-generation neural networks to build powerful GAN models using Python, Packt Publishing.
6. Daniel Jurafsky and James H. Martin, Speech and Language Processing, Person Publication


**E-RESOURCES**


1. https://doi.org/10.1145/3234150
2. https://www.sciencedirect.com/science/article/pii/S1574013721000198?via
3. https://ieeexplore.ieee.org/document/10193469
4. https://doi.org/10.1007/s40745-015-0040-1

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | PREDICTIVE ANALYTICS LAB |
| | COURSE CODE | 2304326L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Descriptive Analytics

**COURSE OBJECTIVES :**

2304326L.CEO.1: To understand the advanced classification techniques.
2304326L.CEO.2: To use the basic terminology of artificial neural networks.
2304326L.CEO.3: To understand the deep neural networks..
2304326L.CEO.4: To illustrate the unsupervised learning methods.
2304326L.CEO.5: To explain basic terminology of natural language processing.
2304326L.CEO.6: To explain ensemble learning

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304326L.CO.1: Apply predictive analytics techniques to solve a given problems. [L3] 2304326L.CO.2: Select efficient analytics techniques for multimedia dataset.[L3].
2304326L.CO.3: Infer from the survey of existing preditive algorithms and methods.[L4] 2304326L.CO.4: Create an application to solve any real world problem using appropriate predictive analytics techniques.[L6]

**COURSE ABSTRACT:**

Predictive analytics is a powerful field that leverages data science to make informed decisions, antici- pate future trends, and optimize strategies across various domains. This comprehensive course delves into advanced predictive analytics methodologies, equipping participants with the knowledge and skills necessary to extract actionable insights from data.Throughout the course, participants will explore cutting-edge techniques including advanced classification, artificial neural networks (ANNs), deep neu- ral networks (DNNs), Ensemble Learning methods, clustering techniques, and ensemble techniques

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Implementation of classiftcation algorithms (any two ) (Naïve bays, BBN, KNN, CART,SVM etc)** | **4 HOURS** |
| Further practice: Develop a application using any front end tool to use classification algorithm, | | |
| **PRACTICAL NO.02** | **Problem solving using clustering algorithm** | **4 HOURS** |
| Further practice: Implement any one advance clustering techniques. | | |
| **PRACTICAL NO.03** | **Deep learning applications for given case study.** | **4 HOURS** |
| Apply hypertunning paramter to increase the accuracy of deep neural netwok | | |
| **PRACTICAL NO.04** | **Application of Hidden Markov Model for solving problem of natural language processing.** | **4 HOURS** |
| Further practice: Student has to apply for HMM for Part of Speech problem. | | |
| **PRACTICAL NO.05** | **Apply Adversarial Neural Network** | **4 HOURS** |
| Further practice: Evaluate the performance analysis. | | |
| **PRACTICAL NO.06** | **Mini Project** | **10 HOURS** |
| Data science solution for real word problems – project ( group 3 ) duration 1 month ( Problems include image processing, video processing will be preferred) Real life problem statements from associated industries will be shared with students and assessment will be done with the help of industry experts. These problems would cover all branches of engineering. The project includes survey of existing model. Finding researh gap and providing methods/idea for improvement. Implementation of Methods/Ideas. Inference from the experimentation. | | |

**TEXT BOOKS**


1. Murrey R Spiegal, Larry Stifens, "Statistics" , 5th edition ,Schaum's Series, McGraw-Hill Edu- cation; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527
2. Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.
3. Alpaydin, E. (2010). Introduction to Machine Learning. MIT Press.
4. Francois Chollet, Deep Learning with Python, Manning Publications.
5. Stefano van der Walt and Sharon Zhou, Hands-On Generative Adversarial Networks with PyTorch 1.x: Implement next-generation neural networks to build powerful GAN models using Python, Packt Publishing


**REFERENCE BOOKS**


1. Murrey R Spiegal, Larry Stifens, "Statistics" , 5th edition ,Schaum's Series, McGraw-Hill Edu- cation; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527
2. Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.
3. Alpaydin, E. (2010). Introduction to Machine Learning. MIT Press.
4. Francois Chollet, Deep Learning with Python, Manning Publications.
5. Stefano van der Walt and Sharon Zhou, Hands-On Generative Adversarial Networks with PyTorch 1.x: Implement next-generation neural networks to build powerful GAN models using Python, Packt Publishing.
6. Daniel Jurafsky and James H. Martin, Speech and Language Processing, Person Publication


**E-RESOURCES**


1. https://doi.org/10.1145/3234150
2. https://www.sciencedirect.com/science/article/pii/S1574013721000198?via
3. https://ieeexplore.ieee.org/document/10193469
/ 4. https://doi.org/10.1007/s40745-015-0040-1

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | DEEP LEARNING |
| | **COURSE CODE** | 2304327T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Statistics and Integral Calculus, Artificial Intelligence and Machine learning

**COURSE OBJECTIVES :**

2304327T.CEO.1: Develop a comprehensive understanding of the mathematical foundation of neural network employed on static and dynamic data set.

2304327T.CEO.2: Apply algorithms to solve real-world problems in computer vision, natural language processing, and other domains.

2304327T.CEO.3: To analyze the performance of various approaches of deep learning algorithms.

2304327T.CEO.4: Handle techniques for evaluating and fine-tuning model performance

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304327T.CO.1: Model the mathematical intuition of underlying neural networks for its application to both static and dynamic datasets[L3].

2304327T.CO.2: Apply relevant deep learning algorithms to develop intelligent systems in various real world domains[L3]

2304327T.CO.3: Evaluates the performance of intelligent models using various evaluation techniques and metrics[L5].

2304327T.CO.4: Fine-tune hyper-parameters to optimize intelligent models[L4].

2304327T.CO.5: Analyse the relative advantages and limitations of various deep learning algorithms[L5]

**COURSE ABSTRACT:**

This course explores deep learning in artificial intelligence, covering its fundamental principles, methodologies, and practical applications. It covers neural networks, convolutional and recurrent neural networks, and their applications in image classification, object detection, segmentation, natural language processing, and time series analysis. The course also covers reinforcement learning and transfer learn- ing techniques. The course emphasizes both theoretical understanding and practical implementation, combining lectures with hands-on exercises and projects. Students gain a comprehensive understanding of deep learning concepts and skills in applying these techniques to real-world datasets and challenges. This equips students with the knowledge and proficiency to contribute to AI-driven solutions across various industries.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Fundamental of Neural network** | **07 HOURS** |

**Applications/Case Study:** Customer Engagement

**Contents:**Neural Network Contents: Neural Network: Introduction to Neural Networks, Fundamental Concepts: Neuron Models And Basic Learning Rules, Perceptron Training Rule, Gradient Descent And Delta Rule, Back- Propagation Algorithm,Loss Functions, Multi layer Network,Regularization techniques.

**Self Study:** Activation Function

**Further Readings:** Optimization Algorithms

| | | |
|---|---|---|
| **UNIT 2** | **Deep Convolutional Neural network** | **08 HOURS** |

**Applications/Case Study:** Chest X Ray Image Classification

**Contents:**Convolutional Neural Network (CNN)Architecture, Activation Functions, Training and Back-propagation Transfer Learning:Approaches,Pre-trained Models,Fine-tuning and Feature Extrac- tion. Object Detection: Faster R-CNNs, YoLO,evaluation metrics.

**Self Study:**RetinaNet

**Further Readings:**Graph Convolutional Neural Networks

| | | |
|---|---|---|
| **UNIT 3** | **Deep Quantum Computing** | **08 HOURS** |

**Applications/Case Study:** Quantum-enhanced image classification

**Contents:** Quantum Mechanics Foundations,Quantum Gates and Circuits,Quantum Algorithms,Overview of Quantum CNN,Architecture of Quantum CNN, Quantum CNN Operations simulators -IBM's Qiskit, PennyLane, or Google's Cirq.

**Self Study:** Quantum Error Correction

**Further Readings:**Quantum Hardware

| UNIT 4 | Time Series Analysis | 08 HOURS |
|---|---|---|
| **Applications/Case Study:** Marketing and Customer Analytics<br>**Contents:** Time Series Data,Time Series Decomposition Statistical Models:Autoregressive Inte- grated Moving Average (ARIMA), Forecasting Techniques, Sequence Model,Understanding sequential data,Types of sequence models,Hidden Morkow Model,Recurrent Neural Network,Vanishing gradient Problem,Long Short term Memory,Gated Recurrent Unit,mathematical modeling of behind sequence model.<br>**Self Study:** Seasonal Decomposition of Time Series (STL)<br>**Further Readings:**Stochastic recurrent neural network | | |
| **UNIT 5** | **Sequence to Sequence Models** | **08 HOURS** |
| **Applications/Case Study:** Text Summarization and Machine Translation<br>**Contents:**Overview of Natural language processing, Introduction to Seq2Seq models,Encoder-Decoder Architecture,Attention Mechanism, Transformer-based Seq2Seq Models: Introduction of transformer architecture and self-attention mechanisms for parallelized computation,Handling Variable-Length Se- quences,Evaluation Metrics: BLEU for machine translation and ROUGE for summarization.<br>**Self Study:** Teacher Forcing,Beam Search<br>**Further Readings:** Fine-tuning encoder and decoder | | |
| **UNIT 6** | **Explainable AI** | **06 HOURS** |
| **Applications/Case Study:** Interpreting Diabetes Risk Predictions.<br>**Contents:** Introduction to Explainable AI,Model-Specific, Model-Agnostic:LIME (Local Interpretable Model-agnostic Explanations): Approximating models with simple interpretable ones. SHAP (SHapley Additive exPlanations).<br>**Self Study:**Trends in research (causality in XAI, human-centered AI). The role of XAI in AI governance and regulation.<br>**Further Readings:** Ethical considerations: Bias, fairness, and regulatory compliance (GDPR, etc.) | | |

**TEXT BOOKS**


1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016). *Deep Learning*. 1st Edition, The MIT Press . ISBN 978-0262035613.
2. Aurélien Géron(2019) *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition*. 1st Edition,Packt Publishing. ISBN 9781492032649.


**REFERENCE BOOKS**


1. Maxim Lapan.(2018).*Deep Reinforcement Learning Hands-On*Packt Publishing. ISBN 978-1788834247
2. Seth Weidman.(2019).*Deep Reinforcement Learning Hands-On*Packt Publishing. ISBN 978-1788834247


**E-BOOKS/E-CONTENTS LINKS**


1. Dive into Deep Learning:Aston Zhang, Zachary C. Lipton, Mu Li, And Alexander J.Smola. (2024). *Dive into Deep Learning* Paperback. ISBN 1009389432. link- https://d2l.ai/d2l-en.pdf
2. https://developer.nvidia.com/deep-learning
3. https://builtin.com/machine-learning/deep-learning
4. https://www.deeplearningbook.org/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | DEEP LEARNING LAB |
| | **COURSE CODE** | 2304327L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Statistics and Integral Calculus, Artificial Intelligence and Machine learning

**COURSE OBJECTIVES :**

2304327L.CEO.1: Develop hands-on skills to implement and train deep learning models using popular frameworks.

2304327L.CEO.2: Identify problems that can be effectively addressed using deep learning solutions.

2304327L.CEO.3: Evaluate the performance of deep learning models using evaluation metrics.

2304327L.CEO.4: Assess the strengths and limitations of different deep learning approaches.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304327L.CO.1: Develop critical thinking skills by solving real-world problems using deep learning algorithm.[L4]

2304327L.CO.2: Investigate strategies for improved model generalization, reducing overfitting, enhancing unseen performance.[L4]

2304327L.CO.3: Optimize models by fine-tuning hyperparameters for task-specific and dataset-specific optimal performance.[L5]

2304327L.CO.4: Discuss results to draw conclusions on problem-solving method effectiveness.[L5]

2304327L.CO.5: Improve collaboration through group discussions, sharing insights, and contributing to DL projects in lab settings. [L5]

**COURSE ABSTRACT:**

This course explores deep learning in artificial intelligence, covering its principles, methodologies, and practical applications. Students will learn about neural networks, convolutional neural networks, and re- current neural networks, and their roles in tasks like image classification, object detection, segmentation, natural language processing, and time series analysis. The course combines theoretical understanding with practical implementation through lectures, exercises, and projects. Lab components include hands- on exercises, project-based assignments, experimentation with pre-trained models, and integration with web applications. Students will gain a comprehensive understanding of deep learning principles and methodologies.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Neural Networks design and deployment** | **4 HOURS** |
| 1. Model Development: Design and train the neural network with appropriate architecture, loss function, optimizer, and data handling techniques, ensuring model accuracy and performance through evaluation and hyperparameter tuning. | | |
| **PRACTICAL NO.02** | **Transfer Learning** | **6 HOURS** |
| 1. Transfer Learning Model Development: Fine-tune a pre-trained model on your specific dataset, adjusting the top layers and optimizing hyperparameters to achieve desired performance metrics. | | |
| **PRACTICAL NO.03** | **Object Detection and Multi object classiftcation** | **4 HOURS** |
| 1. Dataset Preparation and Model Design: Select and preprocess a dataset with annotations for object detection, segmentation masks, and class labels. Design a deep learning architecture that integrates object detection, segmentation, and recognition tasks.<br>2. Model Training and Optimization: Train the multi-task model, experiment with hyperparameters, and fine-tune using transfer learning. Implement optimization techniques to enhance performance.<br>3. Evaluation and Visualization: Evaluate the model on a test dataset, create visualizations of predictions, and discuss challenges and potential real-world applications. | | |
| **PRACTICAL NO.04** | **Natural Language Processing** | **4 HOURS** |
| 1. Data Preparation: Obtain a dataset with sentiment labels, clean the data using NLP tools, and visualize sentiment distribution.<br>2. Text Representation and Model Training: Convert text to numerical vectors using TF-IDF or word embeddings, implement a baseline model, and split the dataset into training and testing sets.<br>3. Evaluation and Conclusion: Evaluate models on the test set using relevant metrics, summarize key findings, suggest improvements, and recommend future research directions. | | |
| **PRACTICAL NO.05** | **Sequence Classiftcation** | **4 HOURS** |

1. Development: Design and train a deep sequence model (e.g., RNN, LSTM, GRU, Transformer) using a suitable dataset for sequence classification tasks, ensuring to preprocess the data appro- priately and tune hyperparameters for optimal performance.
2. Evaluation: Validate the model's performance on a separate test set, using metrics like accuracy, precision, recall, and F1-score to assess its effectiveness in classifying sequences accurately.

| PRACTICAL NO.06 | Sequence Generation | 6 HOURS |
|---|---|---|

1. Model Design and Training: Construct and train a deep sequential model (e.g., LSTM, GRU, Transformer) on a dataset of sequences, focusing on generating new sequences by learning patterns from the input data.
2. Evaluation and Fine-tuning: Assess the model's ability to generate coherent and relevant sequences by comparing generated sequences against a validation set, and fine-tune the model's parameters to improve generation quality.

| PRACTICAL NO.06 | Mini Project (Object detection/NLP). | 6 HOURS |
|---|---|---|

1. The mini project aims to create a real-time object detection/langauge based web application that uses a pre-trained deep learning model to identify objects in a live webcam feed or dynamic data.
2. The project involves selecting a suitable dataset and model, pre-processing the data, integrating the model, developing the web application, deploying it, and documenting the project.
3. The project will take five weeks, with a maximum of three students participating. The team will prepare a project plan, select a real-time dataset, and select a pre-trained model.
4. The project will also involve data pre-processing, model integration, web application development, deployment, and documentation.
5. Regular communication and collaboration will be maintained throughout the project, with the goal of having a fully functional real-time object detection or NLP web application ready for deployment.

**TEXT BOOKS**


1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016). *Deep Learning*. 1st Edition, The MIT Press . ISBN 978-0262035613.
2. Rajalingappaa Shanmugamani(2018) *Deep Learning for Computer Vision*. 1st Edition,Packt Publishing. ISBN 978-1788295628.
3. Aurélien Géron(2019) *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*. 1st Edition,O'Reilly Media. ISBN 978-149203264.


**REFERENCE BOOKS**


1. A. B. A. Arriola, J. R. G. de C. Santos, and J. A. de Morais Amado.(2021). *Quantum Neural Networks*,Springer Publishing. ISBN: 978-3030641911
2. Seth Weidman.(2019).*Deep Reinforcement Learning Hands-On*Packt Publishing. ISBN 978-1788834247
3. Parikshit N. Mahalle and Poonam N.(2021) *Explainable AI: Foundations, Applications, and Challenges*, Wiley-Scrivener Publishing. ISBN-13: 978-1119786202


**E-R ESOURCES**

1. Dive into Deep Learning:Aston Zhang, Zachary C. Lipton, Mu Li, And Alexander J.Smola.(2024). *Dive into Deep Learning*Paperback. ISBN 1009389432. link- https://d2l.ai/d2l-en.pdf
2. https://developer.nvidia.com/deep-learning
3. https://builtin.com/machine-learning/deep-learning
4. https://www.deeplearningbook.org/
5. https://www.ibm.com/topics/explainable-ai
6. https://research.ibm.com/topics/quantum-machine-learning

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | CLOUD NATIVE APPLICATION DEVELOPMENT |
| | **COURSE CODE** | 2304328T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Data Structures, Database Management Systems, Cloud Computing Foundations

**COURSE OBJECTIVES :**

2304328T.CEO.1: To understand how to program various AWS services using SDK
2304328T.CEO.2: To decide the selection of various database services provided by AWS
2304328T.CEO.3: To learn the concept of Infrastructure as a Code
2304328T.CEO.4: To develop the server less applications

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304328T.CO.1: To choose between server based and serverless services to deploy the application on cloud platform [L3]
2304328T.CO.2: To make use of SDKs to programmatically access the AWS Services [L3] 2304328T.CO.3: To distinguish between protocols for developing own API [L4]
2304328T.CO.4: To select an appropriate configuration for provisioning infrastructure as a code [L5]
2304328T.CO.5: To develop and deploy a web application using various cloud services [L6]

**COURSE ABSTRACT:**

The cloud has transformed our lives as individuals as well. Many of us use cloud services every day. When we update our status on social media, binge a new streaming series, or check our bank accounts we're most likely using applications that are hosted by cloud services. These apps are accessed through an internet connection rather than installed on our hard drives or devices.

The main objective of this course is to learn application development using Amazon AWS cloud provider. Finally, the students must develop an end to end application considering some user requirements by applying front-end and back-end technologies which will be deployed on AWS platform.

**THEORY COURSE CONTENT**

| | | |
|---|---|---|
| **UNIT 1** | **Programming AWS Services** | **7 HOURS** |

**App/System/Case study:** AWS EC2, Amazon S3, Amazon RDS, AWS DynamoDB, AWS IAM **Contents:** IIntroduction to boto3 module for programming in Python Managing EC2 instances, IAM Operations, VPC Components using Python Programming with AWS RDS, AWS DynamoDB, AWS DocumentDB and AWS Elasticache in Python

**Self Study:** Programming AWS Services using JavaScript

**Further Reading:** AWS LaunchWizard

| | | |
|---|---|---|
| **UNIT 2** | **Provosioning Infrastructure Through Code** | **7 HOURS** |

**App/System/Case study:** Amazon CloudFormation

**Contents:** Cloud Formation concepts, How does Cloud Formation works, , Working with Stacks, Working with Templates, Working with StackSets, Using the Cloud Formation Registry, Logging API Calls, Infrastructure Security, Configuration and vulnerability analysis

Infrastructure provisioning using Terraform

**Self Study:** AWS Lake Formation

**Further Reading:** ArgoCD

| | | |
|---|---|---|
| **UNIT 3** | **AWS Serverless** | **7 HOURS** |

**App/System/Case study:** AWS Lambda, AWS Step Functions

**Contents:** Need for Serverless architecture, How serverless architecture works

Foundations of Lamdba Functions – concepts, features, programming model, architectures, function scaling, Lambda Permissions – Execution role, resource based policies, user policies, Configuration Functions, Managing Functions, Invoking Functions, lambda Functions AWS Step Functions Designing a workflow using AWS Step Functions.

**Self Study:** AWS Lake Formation

**Further Reading:** Writing AWS Lambda Functions in JavaScript

| UNIT 4 | API Development and Management in AWS | 7 HOURS |
|---|---|---|

**App/System/Case study:** Amazon API Gateway

**Contents:** Understanding REST principles, Defining resources and methods

Overview of API Gateway - key features and benefits, creating an API using API Gateway Console, Configuring stages and deployments, Integrating with backend services - Lambda integration, integrat- ing with AWS Services like S3, DynamoDB, API Keys and usage plans, Caching in API Gateway

**Self Study:** WebSocket API

**Further Reading:** Exporting API using OpenAPI Standards

| UNIT 5 | Building CI/CD Pipelines on AWS | 7 HOURS |
|---|---|---|

**App/System/Case study:** Amazon CodeCommit, Amazon CodeBuild, AWS CodeDeploy, AWS CodePipeline

**Contents:** What is CI/CD? CodePipeline concepts, How pipeline execution works, Integration with CodePipeline action types, working with pipelines, working with actions, working with stage transitions, monitoring pipelines, security in pipelines

AWS CodeCommit, AWS CodeBuild, AWS CodeDeploy

Introduction to Jenkins

**Self Study:** ClouWatch Events for Pipelines

**Further Reading:** Jenkins Pipelines

| UNIT 6 | Advanced Topics in AWS Development | 7 HOURS |
|---|---|---|

**App/System/Case study:** AWS CDK, AWS SAM, AWS Cognito, AWS XRay

**Contents:** AWS CDK - Overview, Benefits, Key concepts and terminology - constructs, stacks, apps, Supported programming languages, Launching resources using AWS CDK

AWS SAM - Introduction, key features, benefits, SAM template anatomy, Creating serverless functions, Building and deploying applications

Amazon Cognito - Introduction, User pools and identity pools, Adding social identity providers (like Facebook, Google, etc.) to the app

AWS X-Ray - Introduction, Setup, Instrumenting application code to generate trace data, Understand- ing trace data and segments, Visualizing trace data using AWS X-Ray console, Using X-Ray SDKs for various programming languages

**Self Study:** AWS Parameter Store

**Further Reading:** AWS Secrets Manager

**TEXT BOOKS**


1. Wittig, Michael, Andreas Wittig, and Ben Whaley. (2015). Amazon web services in action. Manning, Dreamtech Press, ISBN:978-9351198758.
2. Murty, James. Programming amazon web services: S3, EC2, SQS, FPS, and SimpleDB. (2008). O'Reilly Media, Inc.", ISBN 978-0596515812.
3. Tankariya, Vipul, and Bhavin Parmar. (2019). AWS Certified Developer-Associate Guide: Your one-stop solution to pass the AWS developer's certification. 2nd Edition, Packt Publishing Ltd, ISBN 978-1789617313.
4. Alteen, Nick, et al. (2019). AWS Certified Developer Official Study Guide: Associate (DVA-C01) Exam. John Wiley Sons,
5. Van Vliet, Jurg, Flavia Paganelli, and Jasper Geurtsen. (2013). Resilience and Reliability on AWS: Engineering at Cloud Scale. O'Reilly Media, Inc.,
6. Sarkar, Aurobindo. (2018). Learning AWS: Design, build, and deploy responsive applications using


**REFERENCE BOOKS**


1. Kavis, Michael J. (2014). Architecting the cloud: design decisions for cloud computing service models (SaaS, PaaS, and IaaS). John Wiley Sons, ISBN 978-1118617618.
2. Vacca, John R. (2020). Cloud computing security: foundations and challenges. 2nd Edition, CRC Press, ISBN. 978-0367560331.
3. Furht, Borivoje, and Armando Escalante. (2014). Handbook of cloud computing. Vol. 3. New York: springer. , ISBN. 978-1489994561.


**E-RESOURCES**

1. https://docs.aws.amazon.com/
2. https://www.workshops.aws/
3. https://www.terraform.io/
4. https://boto3.amazonaws.com/v1/documentation/api/latest/index.html

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Cloud Native Application Development Lab |
| | COURSE CODE | 2304328L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE KNOWLEDGE :** Data Structures, Database Management Systems, Cloud Computing Foundations

**COURSE OBJECTIVES :**

2304328L.CEO.1: To understand how to program various AWS services using SDK
2304328L.CEO.2: To decide the selection of various database services provided by AWS
2304328L.CEO.3: To learn the concept of Infrastructure as a Code
2304328L.CEO.4: To develop the server less applications

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304328L.CO.1: To model the program for accessing AWS Services programmatically [L3]
2304328L.CO.2: To build the API using various protocols [L4]
2304328L.CO.3: To choose an appropriate configuration for provisioning infrastructure as a code [L5]
2304328L.CO.4: To develop and deploy a web application using various cloud services [L6]

**COURSE ABSTRACT:**

The cloud has transformed our lives as individuals as well. Many of us use cloud services every day. When we update our status on social media, binge a new streaming series, or check our bank accounts we're most likely using applications that are hosted by cloud services. These apps are accessed through an internet connection rather than installed on our hard drives or devices.

The main objective of this course is to learn application development using Amazon AWS cloud provider. Finally, the students must develop an end to end application considering some user requirements by applying front-end and back-end technologies which will be deployed on AWS platform.

**PRACTICAL:**

| **PRACTICAL NO.01** | **Programming AWS Services in Python** | **6 HOURS** |
|---|---|---|

- Write a program in Python to count the number of running, stopped and terminated instances
- Write a program in Python to start all the stopped instances
- Write a program in Python to stop all the running instances
- Write a program in Python to implement various IAM operations
- Write a program in Python to create VPC components
- Write a program in Python to implement CRUD operations on RDS, DynamoDB tables, Elasti-cache
- Write a program in Python to implement various S3 operations

| PRACTICAL NO.02 | Provisioning Infrastructure Through Code | 6 HOURS |
|---|---|---|
| • Create a CloudFormation Template to create all the VPC Components and Launch an EC2 instance in the VPC created<br>• Implement the concept of changeset using CloudFormation<br>• Implement the concept of nested stacks using CloudFormation<br>• Create a Terraform Template to create all the VPC Components and Launch an EC2 instance in the VPC created | | |
| **PRACTICAL NO.03** | **Serverless Application Development** | **4 HOURS** |
| • Create a Lambda function to receive the details from S3 bucket and display those details<br>• Create a Lambda function to implement CRUD operations for DynamoDB | | |
| **PRACTICAL NO.04** | **API Development and Management in AWS** | **6 HOURS** |
| • Create a REST based API to implement CRUD Operations for DynamoDB<br>• Create a WebSocket API | | |
| **PRACTICAL NO.05** | **Building CI/CD Pipelines on AWS** | **6 HOURS** |
| • Implement CodeCommit for a sample web application<br>• Implement CodeBuild for a sample web application<br>• Implement Code Deploy for a sample web application | | |
| **PRACTICAL NO.06** | **Advanced Topics in AWS Development** | **8 HOURS** |
| • Create AWS SAM Template for creating a Lambda function<br>• Create AWS SAM Template for creating a Step Function<br>• Implement Identity Fedatation using AWS Cognito<br>• Integrate Lambda function with AWS X-Ray | | |
| **PRACTICAL NO.07** | **Project** | **8 HOURS** |
| Select a web application for deployment on AWS Infrastructure. Create an architecture diagram for the deployment. Launch an architecture by developing a template using CloudFormation / Terraform.<br>After the infrastructure is ready deploy the web application using CI/CD Pipeline | | |

**TEXT BOOKS**


1. Wittig, Michael, Andreas Wittig, and Ben Whaley. (2015). Amazon web services in action. Manning, Dreamtech Press, ISBN:978-9351198758.
2. Murty, James. Programming amazon web services: S3, EC2, SQS, FPS, and SimpleDB. (2008). O'Reilly Media, Inc.", ISBN 978-0596515812.
3. Tankariya, Vipul, and Bhavin Parmar. (2019). AWS Certified Developer-Associate Guide: Your one-stop solution to pass the AWS developer's certification. 2nd Edition, Packt Publishing Ltd, ISBN 978-1789617313.
4. Alteen, Nick, et al. (2019). AWS Certified Developer Official Study Guide: Associate (DVA-C01) Exam. John Wiley Sons,
5. Van Vliet, Jurg, Flavia Paganelli, and Jasper Geurtsen. (2013). Resilience and Reliability on AWS: Engineering at Cloud Scale. O'Reilly Media, Inc.,
6. Sarkar, Aurobindo. (2018). Learning AWS: Design, build, and deploy responsive applications using


**REFERENCE BOOKS**


1. Kavis, Michael J. (2014). Architecting the cloud: design decisions for cloud computing service models (SaaS, PaaS, and IaaS). John Wiley Sons, ISBN 978-1118617618.
2. Vacca, John R. (2020). Cloud computing security: foundations and challenges. 2nd Edition, CRC Press, ISBN. 978-0367560331.
3. Furht, Borivoje, and Armando Escalante. (2014). Handbook of cloud computing. Vol. 3. New York: springer. . ISBN. 978-1489994561.


**E-RESOURCES**

1. https://docs.aws.amazon.com/
2. https://www.workshops.aws/
3. https://www.terraform.io/
4. https://boto3.amazonaws.com/v1/documentation/api/latest/index.html

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | CYBER SECURITY AND FORENSICS |
| | **COURSE CODE** | 2304329T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Computer Networks, Operating Systems

**COURSE OBJECTIVES :**

2304329T.CEO.1: To gain a fundamental knowledge of Cyber threats and Cyber vulnerabilities.
2304329T.CEO.2: To understand the security concerns in IoT devices.
2304329T.CEO.3: To implement a secure application and maintain integrity with the help of network security appliances.
2304329T.CEO.4: To ascertain the usefulness of Information and Enterprise security.
2304329T.CEO.5: To know about the forensic analysis and the investigation process.
2304329T.CEO.6: To use the forensics tools in an investigation process.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304329T.CO.1: Outline different software bugs that pose security threats, and it can attack a network. [L2].

2304329T.CO.2: Identify the issues in implementing secure environment while using IoT devices in the organization. [L3].

2304329T.CO.3: Develop a wide network by selecting right systems and ensuring supportive applications that can speed up all the processes. [L3].

2304329T.CO.4: Analyze the fundamental risk management principles and controlling IT operations to implement security guidelines for various types of Industries [L4].

2304329T.CO.5: Examine Forensics systems with respect to maintaining operations in the presence of risks and threats. [L4].

2304329T.CO.6: Evaluate with the help of Digital Forensic tools the security vulnerabilities in the

**COURSE ABSTRACT:**

Cyber Security is an integral part of the network environment. Cyber security is the practice of pro- tecting systems, networks, and programs from digital attacks. These cyber attacks are usually aimed at accessing, changing, or destroying sensitive information; extorting money from users via ransomware; or interrupting normal business processes. Implementing effective cyber security measures is particu- larly challenging today because there are more devices than people, and attackers are becoming more innovative

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **Emerging Cyber Threats and Vulnerabilities** | **08 HOURS** |
| **Applications/Case Study:** Network Security<br>**Contents:** Definition of Cybercrime, Classification of Cybercrimes, Cyber Attacks and Their Counter-measures, Behavioral Aspects of Cyber Security, Role of Cyber Security on Intelligent Transportation Systems, Necessity of Cryptography for Cybersecurity Applications, Application of Cyber Security for Cloud-based Applications. | | |
| **UNIT 2** | **IoT Security and Privacy** | **08 HOURS** |
| **Applications/Case Study:** Display devices- OLEDs, Micro LEDs, Radar displays<br>**Contents:** Trends in Mobility, Security challenges posed by mobile devices, Service Orchestration and Routing for IoT, Privacy, Security, Trust, Identity, and Anonymity in IoT, Threats to mobile ap- plications, analyzers for Mobile Applications to discover Security vulnerabilities, Security architecture in IoT, Android Security Architecture.<br>**Self Study:**Wireless system Design, System architecture, | | |
| **UNIT 3** | **Infrastructure and Application Security** | **06 HOURS** |
| **Applications/Case Study:** Design of different Applications<br>**Contents:** Device Security, Topologies and IDS, Authentication and Authorization, Session Man-agement, Control hijacking attacks – buffer overflow, integer overflow, bypassing browser memory protection, Privilege, access control and Operating System Security, Case Study: Security of E-mail System, Database Security basics.<br>**Self Study:** Firewall Implementation | | |
| **UNIT 4** | **Information and Enterprise Security** | **06 HOURS** |
| **Applications/Case Study:** Enterprise Network<br>**Contents:** Definition, Terminologies, Goals of Information Security and Implementation issues, Access control- password, MFA, -, Security issues in Cloud Computing, Introduction to Enterprise Security, Planning and designing the Security Architecture, Security Architecture: Operations, Security Governance and Risk Management.<br>**Self Study:** E-mail System | | |
| **UNIT 5** | **Digital Forensics** | **06 HOURS** |
| **Applications/Case Study:** Forensics Analysis<br>**Contents:** Overview of Digital Forensics, the sub disciplines, Digital Evidence, Forensics analysis of email, Digital Forensics Life Cycle, Chain of Custody concept, Network Forensics, Relevance of OSI Layers, Data Recovery and OS Forensics, Email Crimes and Violations, Case Study: The Investigation process, Setting up a laboratory.<br>**Self Study:** The methods of data acquisition. | | |

| UNIT 6 | Digital Forensics Tools | 06 HOURS |
|---|---|---|

**Applications/Case Study:** How can a tool be used for forensic analysis

**Contents:** Best Practices, what makes a tool forensically sound, performing tool testing, Classes of Forensics tools.

**Self Study:** Implementation of any tool using kali Linux.

**TEXT BOOKS**


1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunit Belpure, Wiley India Edition.
2. Information Systems Security: Security Management, Metrics, Frameworks and best Practices by Nina Godbole Wiley India Edition
3. Cyber SECURITY Protecting Critical Infrastructures from Cyber Attack and Cyber Warfare, Thomas Johnson, CRC Press, taylor Franscis Group
4. Digital Forensics for Legal Professionals: Understanding Digital Evidence from the Warrant to the Courtroom, Larry Daniel, Lars Daniel


**REFERENCE BOOKS**


1. Security Architecture: Design, Deployment and Operations by Christopher King, Curtis Dalton, T.Ertem Osmanoglu
2. Information Security: Principles and Practices by Mark Merkow, Jim Breithaupt
3. Internet Security: A Jumpstart for Systems Administrators and IT managers by Tim Speed and Juanita Ellis
4. Web Hacking-Attacks and Defence by Stuart McClure, Saumil Shah, Shreeraj Shah
5. Computer Security Principles and Practices: William Stallings and Larry Brown Pearson edition


**E-R ESOURCES**

1. https://nptel.ac.in/courses/106106248

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | CYBER SECURITY AND FORENSICS LAB |
| | COURSE CODE | 2304329L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** NIL

**COURSE OBJECTIVES :**

2304329L.CEO.1: To gain a fundamental knowledge of Cyber threats and Cyber vulnerabilities.
2304329L.CEO.2: To understand the security concerns in web based applications.
2304329L.CEO.3: To implement a secure framework to automate web application security assessment.
2304329L.CEO.4: To ascertain the usefulness of Open Source Intelligence tools.
2304329L.CEO.5: To know about the forensic analysis and the investigation process.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304329L.CO.1: Outline various security threats that can attack the network and the necessary preventive measures implemented using the security policies [L2].
2304329L.CO.2: Identify the injection flaws and ensure website security [L3].
2304329L.CO.3: Develop a framework that can identify the bugs and ensure that the web applications security assessment is done automatically [L3].
2304329L.CO.4: Analyze the bruteforcing Web Applications to discover common vulnerabilities [L4].
2304329L.CO.5: Examine Forensics systems with respect to maintaining operations in the presence of risks and threats. [L4]

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **A. Study of the features of NSA in providing network security and to set Firewall with proper conftgura- tion. B. Conftgure Security parameters in any one web browser C. Study of different types of vulnera- bilities for hacking a websites / Web Applications.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.02** | **Implement a penetration testing tool that automates the process of detecting and exploiting SQL injection flaws and taking over of database servers.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.03** | **Install Kali Linux and utilize various security tools for defense of the system.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.04** | **Implement a framework to automate web applica- tions security assessments and could help you to se- cure your web applications by ftnding and exploiting web application vulnerabilities.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.05** | **Implement wfuzz to discover common vulnerabilities in web applications through the method of fuzzing.** | **2 HOURS** |
| | | |
| **PRACTICAL NO.06** | **Using an OSINT Tool like Shodan or Censys, ftnd out the details about the servers, networks; and internet connected devices.** | **4 HOURS** |
| | | |
| **PRACTICAL NO.07** | **PWN till Dawn lab offensive security** | **2 HOURS** |
| | | |
| **PRACTICAL NO.08** | **Conftgure Wireless Access Point and provide MAC based security. A. Analyze wift traffic. B. Cracking into WEP, WPA2 C. Evil twin attack with fake access point** | **4 HOURS** |
| | | |
| **PRACTICAL NO.09** | **Download and install sleuth kit to identify and re- cover evidence from available data sets** | **2 HOURS** |

**TEXT BOOKS**


1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunit Belpure, Wiley India Edition.
2. Information Systems Security: Security Management, Metrics, Frameworks and best Practices by Nina Godbole Wiley India Edition
3. Cyber Security Protecting Critical Infrastructures from Cyber Attack and Cyber Warfare, Thomas Johnson, CRC Press, taylor Franscis Group
4. Digital Forensics for Legal Professionals: Understanding Digital Evidence from the Warrant to the Courtroom, Larry Daniel, Lars Daniel


**REFERENCE BOOKS**


1. Security Architecture: Design, Deployment and Operations by Christopher King, Curtis Dalton, T.Ertem Osmanoglu
2. Information Security: Principles and Practices by Mark Merkow, Jim Breithaupt
3. Internet Security: A Jumpstart for Systems Administrators and IT managers by Tim Speed and Juanita Ellis
4. Web Hacking-Attacks and Defence by Stuart McClure, Saumil Shah, Shreeraj Shah
5. Computer Security Principles and Practices: William Stallings and Larry Brown Pearson edition

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Linux Administration -II |
| | COURSE CODE | 2304366L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Fundamental of Linux operating system, Operating system

**COURSE OBJECTIVES :**

2304366L.CEO.1: To configuring, installing, and upgrading Linux systems using established standards and procedures.

2304366L.CEO.2: To understand security policies using SELinux .

2304366L.CEO.3: To understand filesystems ,partitioning,Logical volume

2304366L.CEO.4: Gain sufficient skill to perform advance system administration tasks on Red Hat Enterprise Linux

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304366L.CO.1: Utilize advance Linux administration tasks [L3].

2304366L.CO.2: Experiment with installation,virtual machine and containers [L3]. 2304366L.CO.3: Examine physical storage, file systems ,Logical volume,Network file system [L3].

2304366L.CO.4: Inspect the Linux processes,control services,daemons and advance security administration.[L4].

2304366L.CO.5: Analyze Redhat Linux System with a comprehensive and systematic approach [L4].

**COURSE ABSTRACT:**

This course is specifically designed for students who have completed System Administration I . Linux System Administration II (RH134) focuses on the key tasks needed to become a full time Linux Administrator and to validate those skills . This course goes deeper into Enterprise Linux administration including filesystems and partitioning, logical volumes, SELinux, firewalling, and troubleshooting.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Improving Command-line Productivity:Writing Sim- ple Bash Scripts,Running Commands More Effi- ciently Using Loops,Matching Text in Command Output with Regular Expressions** | **4 HOURS** |
| **PRACTICAL NO.02** | **Scheduling Future Tasks,Scheduling a Deferred User Job,Scheduling Recurring User Jobs,Scheduling Recurring System Jobs,Managing Temporary Files** | **4 HOURS** |
| **PRACTICAL NO.03** | **Tuning System Performance: Adjusting Tuning Proftles,Influencing Process Scheduling** | **4 HOURS** |
| **PRACTICAL NO.04** | **Controlling Access to Files with ACLs,Interpreting File ACLs,Securing Files with ACLs** | **4 HOURS** |
| **PRACTICAL NO.05** | **Managing SELinux Security: Changing the SELinux Enforcement Mode,Controlling SELinux File Contexts,Adjusting SELinux Policy with Booleans, Investigating and Resolving SELinux Issues** | **6 HOURS** |
| **PRACTICAL NO.06** | **Managing Basic Storage:Adding Partitions, File Systems, and Persistent Mounts,Managing Swap Space** | **6 HOURS** |
| **PRACTICAL NO.07** | **Managing Logical Volumes,Creating Logical Volumes,Extending Logical Volumes** | **4 HOURS** |
| **PRACTICAL NO.08** | **Implementing Advanced Storage Features:Mounting Network-Attached Storage with NFS,Automounting Network-Attached Storage** | **4 HOURS** |
| **PRACTICAL NO.09** | **Accessing Network-Attached Storage: Mounting Network-Attached Storage with NFS,Automounting Network-Attached Storage** | **4 HOURS** |
| **PRACTICAL NO.10** | **Controlling the Boot Process:Selecting the Boot Target,Resetting the Root Password,Repairing File System Issues at Boot,Repairing File System Issues at Boot** | **6 HOURS** |
| **PRACTICAL NO.11** | **Managing Network Security:Managing Server Firewalls,Controlling SELinux Port Labeling** | **6 HOURS** |

| | | |
|---|---|---|
| **PRACTICAL NO.12** | **IRunning Containers,Introducing Containers,Running a Basic Container, Finding and Managing Container Images,Performing Advanced Container Management, Attaching Persistent Stor- age to a Container,Managing Containers as Services.** | **6 HOURS** |
| **PRACTICAL NO.13** | **Installing Red Hat Enterprise Linux: Installing Red Hat Enterprise Linux, Automating Installation with Kickstart,Installing and Conftguring Virtual Ma- chines** | **2 HOURS** |

**TEXT BOOKS**

1. Red Hat Enterprise Linux 9.0, "RH134: RED HAT SYSTEM ADMINISTRATION I", Student Guide

**REFERENCE BOOKS**

1. Red Hat Enterprise Linux 8.2, "RH134: RED HAT SYSTEM ADMINISTRATION II", Student Guide

**E-R ESOURCES**

1. https://rha.ole.redhat.com/rha/app/courses/rh124

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | CLOUD SERVICES |
| | **COURSE CODE** | 2304367L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE KNOWLEDGE :** Cloud Computing Foundations

**~~COURSE OBJECTIVES~~ :**

2304367L.CEO.1: Identify global infrastructure components of AWS.
2304367L.CEO.2: Differentiate between Amazon S3, EBS, EFS, S3 Glacier.
2304367L.CEO.3: Explore key concepts to Elastic Load Balancing, Amazon CloudWatch, EC2.

**~~COURSE OUTCOMES~~ :**

After successful completion of the course, students will be able to,

2304367L.CO.1: Define different types of cloud computing models and Services and Services Categories [L2].
2304367L.CO.2: Create own VPC and add additional components to produce customized network [L6].
2304367L.CO.3: Demonstrate AWS Elastic Beanstalk, AWS Lambda [L4].
2304367L.CO.4: Perform tasks in Amazon RDS database such as launching, configuring and interacting. [L3].
2304367L.CO.5: Configure different types of security monitoring AWS Architectures [L5]

**COURSE ABSTRACT:**

Amazon Web Services offers a broad set of global cloud-based products including compute, storage, databases, analytics, networking, mobile, developer tools, management tools, IoT, security, and enterprise applications: on-demand, available in seconds, with pay-as-you-go pricing. From data warehousing to deployment tools, directories to content delivery, over 200 AWS services are available. Learning AWS can help students land a job in the cloud domain, increase their salary, and advance their career. Learning is beneficial for both beginners and intermediate AWS developers with a few years of experience. Students can take up an AWS certification to learn about AWS and build in-demand cloud skills.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **AWS Global Infrastructure** | **6 HOURS** |
| a) Identify the difference between AWS Regions, Availability Zones and edge locations<br>b) Identify AWS services Service categories. | | |
| **PRACTICAL NO.02** | **Network and Content Delivery.** | **6 HOURS** |
| a) Study three fundamental AWS networking and content delivery services: Amazon Virtual Private Cloud (Amazon VPC), Amazon Route 53, and Amazon CloudFront.<br>b) Label a virtual private cloud (VPC) network architecture diagram<br>c) Design a VPC, watch how a VPC is built, and build a VPC. | | |
| **PRACTICAL NO.03** | **Databases** | **8 HOURS** |
| a) Introduction to four of the most commonly used AWS database services:<br>Amazon Relational Database Service (Amazon RDS) Amazon DynamoDB Amazon Redshift Amazon Aurora<br>b) Perform tasks in an Amazon RDS database such as launching, configuring, and interacting. | | |
| **PRACTICAL NO.04** | **Cloud Architectures.** | **6 HOURS** |
| a) Describe the AWS Well-Architected Framework<br>b) Identify the design principles of the AWS Well- Architected Framework<br>c) Explain the importance of reliability and high availability<br>d) Identify how AWS Trusted Advisor helps customers and Interpret AWS Trusted Advisor recommendations | | |
| **PRACTICAL NO.05** | **AWS EC2 Load Balancing** | **8 HOURS** |
| a) Study of three fundamental AWS services Elastic Load Balancing Amazon Elastic Compute Cloud (Amazon EC2) Auto Scaling Amazon CloudWatch<br>b) Build dynamic, scalable architectures.<br>c) Indicate how to distribute traffic across Amazon EC2 instances by sing Elastic Load Balancing | | |

| PRACTICAL NO.06 | AWS Auto Scaling . | 6 HOURS |
|---|---|---|
| a) Identify how Amazon Cloud Watch enables you to monitor AWS resources and applications in real time<br>b) Explain how Amazon EC2 Auto Scaling launches and releases servers in response to workload changes.<br>c) Perform scaling and load balancing tasks to improve an architecture | | |
| **PRACTICAL NO.07** | **AWS Cloud Security .** | **8 HOURS** |
| a) Introduction to the AWS approach to security, controls in the AWS environment<br>b) Describe different types of security credentials in IAM.<br>c) Securing a new AWS account, Explore IAM users and groups. Secure AWS data with different methods. | | |
| **PRACTICAL NO.08** | **Availability and Monitoring .** | **8 HOURS** |
| a) Designing an Environment that's Highly Available<br>b) Creating high available web application<br>c) Monitoring AWS Architecture using Cloud Watch Cloud Trail, Guard Duty | | |

**TEXT BOOKS**


1. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1st Edition
2. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A PracticalApproach", 2010, the McGraw-Hill.


**REFERENCE BOOKS**


1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing: Founda- tions and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.
2. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Cloud Computing Black Book ,Wiley Dreamtech,ISBN:9789351194187
3. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Secu- rity and More, Jones and Bartlett, ISBN: 9789380853772


**E-R ESOURCES**

1. aws.amazon.com/training
2. AWS Academy Educator
3. https://eduskillsfoundation.org/index.php/aws-academy/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | Practitioner's Approach to AI |
| | **COURSE CODE** | 2304368L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Applied Mathematics, Foundation of Computing

**~~COURSE OBJECTIVES~~ :**

2304368L.CEO.1: To Organize raw data of dataset to improve model performance.
2304368L.CEO.2: To Develop critical thinking skills by solving real-world problems.
2304368L.CEO.3: To Fine-tune hyper-parameters to optimize learning models.
2304368L.CEO.4: To Select learning techniques to solve computer vision and Natural Language Processing Problems.

**~~COURSE OUTCOMES~~ :**

After successful completion of the course, students will be able to,

2304368L.CO.1: Implement data preprocessing techniques to improve model performance. [L3]
2304368L.CO.2: Apply different learning Models for evaluation of the strengths and limitations for defined real world problem [L3]
2304368L.CO.3: Analyze the optimal configuration of hyperparameters for enhancing the learning models. [L3]
2304368L.CO.4: Compare the learning algorithms, assessing performance, strengths, and weaknesses comprehensively. [L4]

**COURSE ABSTRACT:**

Practitioner's approach to AI delves into the cutting-edge domain of Artificial Intelligence. In today's rapidly evolving technological landscape, the practical application of Artificial Intelligence (AI) is becoming increasingly prevalent across industries. This comprehensive course is designed to equip practitioners with the knowledge, skills, and tools necessary to leverage AI technologies effectively in real-world scenarios.The course begins by providing a solid theoretical foundation in AI, covering key concepts such as machine learning algorithms, neural networks, and deep learning architectures. However, the pri- mary focus lies on bridging the gap between theory and application, empowering participants to tackle practical AI challenges with confidence.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Implementation of Knowledge based Systems.** | **4 HOURS** |
| a) Develop Vacuum Cleaner Agent Application. b) Develop an knowledge base system consisting of facts and rules about some specialized knowledge domain of your choice. | | |
| **PRACTICAL NO.02** | **Implement searching Algorithms using AI.** | **4 HOURS** |
| Find the shortest path for any particular source and destination using A* Algorithm. | | |
| **PRACTICAL NO.03** | **Analyse the performance of Regression Models for a given Application.** | **6 HOURS** |
| Data Preparation and Model Implementation<br>. Select suitable dataset with continuous target variables.<br>. Preprocess data, handle missing values, and encode categorical features. Model Design and Implementation.<br>. Linear regression, Logistic Regression, Multi Variate Regression Model Training and Evaluation.<br>. Split dataset into training and testing sets.<br>. Train each model on training set.<br>. Evaluate models using appropriate metrics(MSE,RMSE,R2)<br>. Comparative Analysis<br>. Compare performance of various regression techniques.<br>.Analyze strengths, weaknesses, interpretability, computational efficiency, and model complexity. Conclusion<br>. Summarize findings, provide recommendations, and discuss improvement areas<br>. | | |

| PRACTICAL NO.04 | Implement and compare different classiftcation algorithms. | 6 HOURS |
|---|---|---|
| Data Preprocessing: Prepare the dataset by handling missing values, encoding categorical variables, and scaling features.<br>Model Implementation: Develop classification models using Naive Bayes, KNN,SVM and Decision Trees (CART)<br>Training and Evaluation: Train each model on a portion of the dataset and evaluate their performance using relevant metrics (accuracy, precision, recall, F1-score,loss).<br>Comparative Analysis: Compare the results obtained from each algorithm to identify patterns and differences.<br>Conclusion: Summarize the findings and discuss the suitability of each algorithm for various classification tasks. | | |
| **PRACTICAL NO.05** | **Implement and Analyse the effect of Ensemble Learning in Classiftcation** | **4 HOURS** |
| Dataset Selection and Preprocessing:Preprocess images from selected dataset for resizing, normalization, and data augmentation.<br>Stacking: Implement a stacking ensemble using a meta-classifier to combine predictions from base classifiers.<br>AdaBoost: Implement an AdaBoost ensemble using chosen base classifiers. Voting: Implement a voting ensemble that combines the predictions of the base classifiers through majority voting.<br>Model Comparison: Compare the performance of the ensemble models using appropriate classification metrics.<br>Analysis and Interpretation: Analyze the strengths and weaknesses of each ensemble method, explore scenarios where one method may outperform the others, and discuss the impact of diversity among base classifiers on ensemble performance.<br>Conclusion: Summarize the findings, provide insights into when to use each ensemble method, and suggest potential areas for further research or improvement. | | |

| PRACTICAL NO.06 | Design , Implement, and Evaluate Neural Networks for Classiftcation. | 4 HOURS |
|---|---|---|
| ata set preprocessing<br>Neural Network Architecture Design:Create image classification neural network; choose activations, loss, and optimizers.<br>Model Implementation:Implement the neural network framework for data loading, model training, and evaluation.<br>Training the Neural Network:Separate data into training and testing, track loss and accuracy.<br>Model Evaluation: Assess model on test set, compute metrics, and visualize confusion.<br>Hyperparameter Tuning:Explore the impact of hyperparameters on model performance.<br>Conclusion and Reflection: Summarize results and discuss model performance. | | |
| **PRACTICAL NO.07** | **Implement suitable application using Pre-trained Convolutional Neural Network for Image Classiftca-tion** | **6 HOURS** |
| Choose a relevant dataset for image classification.<br>Select a pre-trained CNN model that suits the dataset's nature.<br>Prepare the dataset for training, perform data augmentation, normalization, and preprocessing.<br>Load the pre-trained CNN model and modify the final layers for the specific classification task. Train the modified CNN on the dataset using transfer learning techniques.<br>Evaluate the performance of the fine-tuned model on a separate validation set.<br>Visualize the model's predictions on sample images from the validation set.<br>Compare the fine-tuned model with a baseline model.<br>Experiment with hyperparameter tuning and optimization strategies to improve the model's perfor-mance. | | |
| **PRACTICAL NO.08** | **Design the model for Object Detection, Segmenta-tion, and Recognition Using Deep Learning.** | **4 HOURS** |
| Select a dataset with annotations for object detection, segmentation masks, and class labels.<br>Preprocess the dataset for training, including image resizing, normalizing pixel values, and handling annotations.<br>Design a deep learning model architecture for object detection, segmentation, and recognition. Train the model and implement multi-task learning.<br>Experiment with hyper-parameter values and optimize parameters. Evaluate the model on a separate test dataset.<br>Fine-tune the model using transfer learning.<br>Implement optimization techniques for object detection and segmentation.<br>Create visualizations of model predictions.<br>Discuss challenges and potential real-world applications. | | |

| PRACTICAL NO.09 | Implement and Analyse the performance of different Machine Learning Algorithms for SentimentAnalysis on Review. | 4 HOURS |
|---|---|---|

Data Acquisition and Preprocessing: Obtain dataset with sentiment labels.Perform data cleaning, remove stopwords, punctuation, irrelevant information. Visualize sentiment distribution in dataset.
Text Representation: Convert the preprocessed text data into numerical vectors using techniques such as TF-IDF (Term Frequency-Inverse Document Frequency) or word embeddings like Word2Vec , GloVe.
Model Development: Implement a baseline sentiment analysis model using a machine learning algorithm (e.g., Logistic Regression or Naive Bayes).
Model Training and Evaluation:Divide the dataset into training and testing sets, train both baseline and advanced models on the training set, and evaluate the models on the testing set using metrics.
Conclusion:Summarize Key findings and insights are summarized, along with recommendations for improving model performance and addressing challenges, and suggestions for future research in NLP and sentiment analysis.

| PRACTICAL NO.10 | Implement and Analyse deep sequence models for sequence classiftcation. | 4 HOURS |
|---|---|---|

Select relevant NLP datasets like sentiment analysis, text classification, named entity recognition, or machine translation.
Perform data preprocessing tasks like tokenization, padding, and embedding.
Design sequence model's architecture specifying layers, recurrent layers, and activation functions. Train the sequence model on the selected NLP dataset.
Experiment with hyperparameter values for improved performance. Choose appropriate evaluation metrics for the selected NLP task. Evaluate the trained sequence model on a separate test dataset.
Discuss challenges and considerations during training and evaluation.
Summarize results, discuss strengths and limitations, and provide insights into improvements.

| PRACTICAL NO.11 | Implement deep sequece models for sequence generation. | 4 HOURS |
|---|---|---|

Select a deep learning framework and Seq2seq model suitable for NLP tasks.
Select a relevant dataset relevant to a Seq2seq NLP task.
Perform data preprocessing tasks such as tokenization, padding, and embedding.
Design encoder and decoder architecture, attention mechanism, and activation functions. Train and Experiment with hyperparameter values for improved performance.
Select appropriate evaluation metrics for the selected seq2seq NLP task and compare the model's performance with baseline models or traditional NLP approaches.
Implement optimization techniques to improve the stability and convergence of the seq2seq model. Summarize the results, discuss strengths and limitations, and provide insights into potential improve- ments.

| PRACTICAL NO.12 | Implement Image Synthesis using GAN. | 4 HOURS |
|---|---|---|
| Setup of TensorFlow and Keras, providing a starter code template.<br>Dataset Loading, Generator Model, Discriminator Model, and GAN Model.<br>Compilation of generator, discriminator, and GAN models with appropriate loss functions and optimizers.<br>Training Loop, Evaluation and Visualization, Experimentation, Results and Discussion. | | |
| **MINI PROJECTS** | | **10 HOURS** |
| Implement a mini project making use of the concepts of Machine Learning algorithms, Deep Neural Networks for any of the application domain like computer vision, Matural Language processing. | | |

**TEXT BOOKS**


1. Stuart Russell and Peter Norvig. (2016). Artificial Intelligence: A Modern Approach", Pearson, ISBN: 978-0134610993.
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville. (2016).Deep Learning". The MIT Press,ISBN: 978-0262035613.
3. Christopher M. Bishop. (2006). Pattern Recognition and Machine Learning", Springer, ISBN: 978-0387310732.


**REFERENCE BOOKS**


1. Kevin P. (2012). Murphy,"Machine Learning: A Probabilistic Perspective", ISBN: 978-0262018029,Publisher: MIT Press.
2. Andreas Muller. (2016). "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly; ISBN: 978-9352134571
3. Prateek Joshi. (2016)."Python Machine Learning. Packt Publishing Limited. ISBN-13:978-8120337312
4. Rajalingappaa Shanmugamani.(2018). "Deep Learning for Computer Vision", Packt Publishing, ISBN: 978-1788295628.
5. Aurelien Geron. (2019). "Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor- Flow", O'Reilly Media, ISBN: 978-1492032649.
6. Maxim Lapan. (2018). "Deep Reinforcement Learning Hands-On", Packt Publishing, ISBN: 978-1788834247.
7. Seth Weidman, (2019). "Deep Learning from Scratch" Publisher: O'Reilly Media, ISBN: 978-


**E-R ESOURCES**

1. https://developer.nvidia.com/deep-learning
2. https://builtin.com/machine-learning/deep-learning
3. https://www.deeplearningbook.org/

**TEXT BOOKS**


1. Prashanth K R, Darshan P R, Archana K (2023). *DOTNET Programming Using C#*. 1st Edition, Bluerose Publishers Pvt. Ltd. ISBN 9789358194333.
2. Grover Damini (2011) . *Dot Net Technology* . 2011 Edition, I K International Publishing House Pvt. Ltd ISBN:9789381141342.


**REFERENCE BOOKS**


1. Herbert Schildt (2010). *C# 4.0 The Complete Reference*. 13th Edition, McGraw-Hill, ISBN: 978-0071741163.
2. Kris HermansKris Hermans (2023). *C# 4.0 Mastering .Dot Net Framework: A Comprehensive Guide To Master The .Dot Net Framework*. 1st Edition, Cybellium Ltd.
3. Thuan L. Thai, Hoang Lam (2022). *.NET Framework Essentials Introducing the .NET Framework*. 3rd Edition, O'Reilly Media.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | Web and Desktop Application Development |
| | **COURSE CODE** | 2304369L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE KNOWLEDGE :** Web Technology

**COURSE OBJECTIVES :**

2304369L.CEO.1: To make understand DotNet Framework, Components, Visual Studio Software Installation and the different languages supported in DotNet.

2304369L.CEO.2: To implement C# program structure.

2304369L.CEO.3: To explore the Windows Forms, Namespace, execution of Windows Form, available tools and their events.

2304369L.CEO.4: To provide fundamentals of ADO.NET Architecture with its API, available classes and objects in API.

2304369L.CEO.5: To apply the need of Collections and Assemblies in the DotNet Programming.

2304369L.CEO.6: To implement ASP.NET MVC Architecture for web applications designing

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304369L.CO.1: Implement object-oriented programming in C# [L3]. 2304369L.CO.2: Demonstrate application development with C# basic constructs[L3]. 2304369L.CO.3: Design windows forms for different applications using C# [L6].

2304369L.CO.4: Use Entity Framework to work with relational databases for connecting with C# and ASP.NET applications[L3].

2304369L.CO.5: Develop web applications using a combination of client-side and server-side technologies to build multi-tier application[L6]

**COURSE ABSTRACT:**

The Web and Desktop Application Development course offers a comprehensive exploration offundamental concepts and practical applications of DotNet Programming. Beginning with C# basics and Object-Oriented Programming (OOPs), students delve into advanced topics such as Windows Form designing, ADO.NET for database connectivity, and mastering Collections and Assemblies. The curriculum culminates in a thorough understanding of ASP.NET for web development. Throughout the course, students engage in hands-on learning experiences, including a mini-project where they apply their skills to solve real-world problems by designing softwares and web applications. By the end, students emerge proficient in .NET development, equipped with the knowledge and skills to tackle diverse software engineering challenges.

**PRACTICALS**

| **PRACTICAL NO.01** | **Getting Started with DotNet and Introduction to C#** | **6 HOURS** |
|---|---|---|

Contents to be taught: Introduction to DotNet Framework, DotNet Versions, Visual Studio Versions, Installation, Features of Visual Studio IDE, Creating Project, Solution Using Visual Studio IDE, C# language basics (Syntax, data types, operators).
Practical Statement:

(a) Install Visual Studio and create a simple ”Hello World” console application.

(b) Write a program to demonstrate C# keywords like class, namespace, static, etc.

(c) Write a program to demonstrate C# data types like int, double, string, etc.

(d) Write a program to demonstrate C# operators like arithmetic, relational, logical etc.

(e) Write a program that takes user input and makes a decision based on if-else and switch conditional statements

| **PRACTICAL NO.02** | **OOPs using C# and Exception Handling** | **8 HOURS** |
|---|---|---|

Contents to be taught: Object-Oriented Programming concepts in C# (Classes, Objects, Methods, Inheritance, Polymorphism), Exception Handling. Practical Statement:

(a) Write a program to print numbers from 1 to 100 using a for loop and while loop

(b) Write a program to reverse a string using for/while loop

(c) Write a program to simulate a simple calculator using switch case

(d) Write a program to demonstrate class, objects, access modifiers

(e) Write a program to show inheritance using base and derived classes and also implement encap- sulation using getters and setters

| PRACTICAL NO.03 | Collections and Assemblies | 6 HOURS |
|---|---|---|

Contents to be taught: Collections (Lists, Dictionaries), Assemblies (Types, Creation, Usage).
Practical Statement:

(a) Implement a C# console application that utilizes a collection (e.g., List, Dictionary) to store and manage a list of student records, including their names and grades.

(b) Create a C# class library project containing reusable components for mathematical operations (e.g., addition, subtraction, multiplication). Compile the library into an assembly and demonstrate its usage in multiple C# applications.

(c) Develop a C# program that reads a text file containing a list of words and stores them in a collection. Implement functionality to count the occurrences of each word and display the results in descending order of frequency.

(d) Build a C# application that utilizes a custom assembly containing encryption and decryption methods. Implement functionality to encrypt sensitive data input by the user and decrypt it for display.

| PRACTICAL NO.04 | Windows Forms using C# | 8 HOURS |
|---|---|---|

Contents to be taught: Creating Windows Forms Applications, Working with Controls (Labels, Textboxes, Buttons, etc.), Handling Events, Windows form deployment.
Practical Statement:

(a) Design Student Registrations Windows Form

(b) Design Unit Converter App with for various parameter (temp, length, etc)

(c) Design Simple Calculator App consider all basics operations.

| PRACTICAL NO.05 | ASP.NET MVC Architecture and Introduction | 10 HOURS |
|---|---|---|

Contents to be taught: Introduction to ASP.NET, First MVC Application, Understanding project structure, URL Routing, Introducing URL Patterns ,Creating and Registering a Simple Route, Razor Basic, Implementation of Razor, Razor Markup, View Data, Creating Forms, submit forms using view data, Adding different ASP.net components on pages.
Practical Statement:

(a) Develop a web page for managing products in an online store.

(b) Design a web application for tracking student grades.

(c) Develop an employee directory web application for a company.

| PRACTICAL NO.06 | ADO.NET | 8 HOURS |
|---|---|---|

Contents to be taught: ADO.NET Architecture, Database Connectivity with windows form and ASP.NET application, Basic CRUD operations, Navigation of data in data objects using Disconnection oriented model with SqlDataAdapter DataSet, DataTable, etc.

Practical Statement:

(a) Implement a C# console application that connects to a SQL Server database using ADO.NET. Allow the user to perform basic CRUD operations (Create, Read, Update, Delete) on a table of their choice.

(b) Create an ASP.NET web application that utilizes ADO.NET to connect to a SQL Server database. Develop a page where users can input data into a form and submit it to be stored in the database. Include validation for user input.

| PRACTICAL NO.07 | ASP.NET Development and Deployment Teaching | 10 HOURS |
|---|---|---|

Contents to be taught: Creating Forms, submit forms using view data, Adding different ASP.net components on pages, Authentication using Microsoft Identity, Creating a ASP.net web application with database and all CRUD operations, Areas in MVC 5 ,Filters in MVC5 ,Authorization Filter , Action Filter,Result Filter ,Exception Filter, Deployment of web application on the cloud.

Practical Statement:

(a) Create an ASP.NET web application featuring a user registration form. Utilize ADO.NET to connect to a SQL Server database and implement functionality to insert user information (e.g., username, email, password) into the database upon form submission. Include validation for required fields and email format.

(b) Develop a web page for managing products in an online store. Implement CRUD operations (Create, Read, Update, Delete) using ADO.NET to interact with a SQL Server database. Allow users to add new products, view existing products, update product details, and delete products from the database.

(c) Design a web application for tracking student grades. Create a page where teachers can input student grades for different subjects. Use ADO.NET to store and retrieve grade information from a SQL Server database. Implement features to calculate and display average grades for each student.

| MINI PROJECTS | | 4 HOURS |
|---|---|---|

Design College Placement Tracking System / Time table making system/ Canteen food ordering/Apartment Management System/Matrimony Site/ Gym and Fitness Club Website using C# and Asp.net.

**TEXT BOOKS**


1. Prashanth K R, Darshan P R, Archana K (2023). *DOTNET Programming Using C#*. 1st Edition, Bluerose Publishers Pvt. Ltd. ISBN 9789358194333.
2. Grover Damini (2011) . *Dot Net Technology* . 2011 Edition, I K International Publishing House Pvt. Ltd ISBN:9789381141342.


**REFERENCE BOOKS**


1. Herbert Schildt (2010). *C# 4.0 The Complete Reference*. 13th Edition, McGraw-Hill, ISBN: 978-0071741163.
2. Kris HermansKris Hermans (2023). *C# 4.0 Mastering .Dot Net Framework: A Comprehensive Guide To Master The .Dot Net Framework*. 1st Edition, Cybellium Ltd.
3. Thuan L. Thai, Hoang Lam (2022). *.NET Framework Essentials Introducing the .NET Framework*. 3rd Edition, O'Reilly Media.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Natural Language Processing Lab |
| | COURSE CODE | 2304370L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Requires knowledge of Probability and Statistics, Machine Learning

**~~COURSE OBJECTIVES~~ :**

2304370.CEO. 1: To understand fundamental concepts of natural language structure, processing, and representation for computational models.

2304370.CEO. 2: To develop and implement NLP techniques such as tokenization, tagging, parsing, and information extraction using open-source tool.

2304370.CEO. 3: To apply statistical approaches to real-world NLP applications like sentiment analysis, chatbots, and question-answering systems.

**~~COURSE OUTCOMES~~ :**

After successful completion of the course, students will be able to,

23043270.CO. 1: Apply basic text preprocessing and linguistic analysis techniques on textual data using Python NLP libraries. [L3].

23043270.CO. 2: Perform syntactic and semantic analysis using POS tagging, chunking, parsing, and entity recognition methods. [L4].

23043270.CO. 3: Implement statistical and vector-based models for language understanding. [L4].

23043270.CO. 4: Evaluate deep learning models (LSTM, BERT) for NLP applications. [L5].

23043270.CO. 5: Design and demonstrate real-world NLP systems like chatbots, text classifiers, or summarizers. [L6]

**COURSE ABSTRACT:**

This course on NLP provides a comprehensive overview of aspects of Natural Language Processing (NLP) enabling machines to interpret, process, and generate human language. Students will learn essential text preprocessing, syntactic and semantic analysis, and implementation of classical and neural NLP models. Emphasis is placed on hands-on experimentation with real datasets, using Python and modern NLP frameworks such as NLTK, spaCy, Gensim, TensorFlow, and HuggingFace Transformers. By the end of the course, students will be able to design and evaluate NLP applications like chatbots, text classifiers, and summarizers.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Text Preprocessing and Linguistic Basics** | **6 HOURS** |

Tokenization: Breaking text into words, sentences, or subwords. Morphology: Study of word structure and formation — root, prefix, suffix.

Perform basic text cleaning, tokenization, and morphological analysis using Python NLP libraries.

a. Read a text corpus and perform sentence and word tokenization.
b. Remove stop words and punctuations.
c. Apply stemming and lemmatization using NLTK/spaCy.
d. Analyze frequency of morphemes and roots.

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Part-of-Speech Tagging and Chunking** | **6 HOURS** |

POS Tagging: Assigning word classes (noun, verb, adjective, etc.) using probabilistic models. Constituency Grammar: Parsing sentences into hierarchical phrase structures (NP, VP).

Identify parts of speech and extract syntactic phrases using parsing.

a. Apply POS tagging using spaCy.
b. Extract noun and verb phrases using chunk grammar.
c. Visualize dependency relations.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Named Entity Recognition (NER)** | **6 HOURS** |

Named Entity Recognition: Identifying named entities such as persons, organizations, and locations.

Information Extraction: Extracting structured data from unstructured text.

Identify entities and categorize them from text using pre-trained NLP models.

a. Perform NER on a news article.
b. Visualize named entities by label.
c. Count frequency of each entity type.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Language Models – N-Gram Approach** | **6 HOURS** |

N-Gram Language Models: Predicting words based on previous N–1 words. Perplexity: Measure of how well a probability model predicts text.

Build unigram, bigram, and trigram models for text generation.

a. Tokenize a corpus and generate n-grams.
b. Compute conditional probabilities for bigrams.
c. Generate sentences using probabilistic selection.
d. Evaluate model perplexity.

| PRACTICAL NO.05 | Vector Semantics and Word Embeddings | 6 HOURS |
|---|---|---|

Distributional Semantics: Meaning inferred from word context ("you shall know a word by the company it keeps"). Word2Vec: Neural embedding model using CBOW or Skip-gram

Represent words as dense vectors and measure semantic similarity.

a. Train Word2Vec model using Gensim.
b. Find most similar words.
c. Visualize word vectors using t-SNE.

| PRACTICAL NO.06 | Text Classiftcation and Sentiment Analysis | 6 HOURS |
|---|---|---|

Bag of Words Model: Representing text as word frequency vectors. Na¨ıve Bayes Classifier: Probabilistic model assuming feature independence.

Classify text (positive/negative) using TF-IDF and Na¨ıve Bayes.

a. Preprocess dataset (movie reviews).
b. Represent text using TF-IDF.
c. Train and test Na¨ıve Bayes model.
d. Evaluate using accuracy and confusion matrix.

| PRACTICAL NO.07 | Sequence Modeling | 8 HOURS |
|---|---|---|

RNN Architecture: Neural network that captures sequential dependencies. LSTM (Long Short-Term Memory): Addresses vanishing gradient problem in long sequences.

Build and train a simple LSTM for text generation.

a. Prepare dataset and encode text.
b. Build an LSTM model using Keras.
c. Train and generate text sequence.

| PRACTICAL NO.08 | NLP Application – Chatbot / QA System | 8 HOURS |
|---|---|---|

**Dialogue Systems:** Conversational agents using intent detection and slot filling. **Transformer Architecture:** Attention-based neural model (e.g., BERT, GPT).

Build a simple chatbot or QA system using a transformer-based model.

a. Implement intent detection using pretrained BERT model.
b. Create chatbot interface (CLI or web).
c. Handle at least 5 intents (greetings, info, farewells, etc.).

| PRACTICAL NO.09 | Text Summarization using HuggingFace Model | 8 HOURS |
|---|---|---|

Implement and compare text summarization techniques using HuggingFace transformer models

a. Choose a long news/Wikipedia article and clean the text (remove extra spaces, special characters).
b. Use any HuggingFace model (e.g., facebook/bart-large-cnn or t5-small) to generate a short summary.
c. Use one more HuggingFace summarization model and compare both summaries based on length, clarity, and meaning.
d. Evaluate Summaries using ROUGE Score and Fine tune the model.

**TEXT BOOKS**


1. Daniel Jurafsky and James H. Martin. (2023). *"Speech and Language Processing"* . 3rd Edition, Pearson Education.
2. Steven Bird, Ewan Klein, and Edward Loper .(2009).*Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit* . O'Reilly Media .


**REFERENCE BOOKS**


1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze (2008). *Introduction to Information Retrieval* . Cambridge University Press .
2. Delip Rao and Brian McMahan. (2019). *Natural Language Processing with PyTorch: Build Intelligent Language Applications* . O'Reilly,


**E-R ESOURCES**

1. https://www.deeplearning.ai/resources/natural-language-processing/
2. https://www.geeksforgeeks.org/natural-language-processing-nlp-tutorial/
3. https://realpython.com/natural-language-processing-spacy-python/
4. https://www.freecodecamp.org/news/natural-language-processing-techniques-for-beginners/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Employability and Career Development |
| | **COURSE CODE** | 2301371L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PRE-REQUISITE KNOWLEDGE :** Communication Skills, Universal Human Values-II.

**COURSE OBJECTIVES :**

2301371L.CEO.1: To define the importance of Employability skills in students life. 2301371L.CEO.2: To explain them necessary, specific Employability Career Development skills. 2301371L.CEO.3: To appraise students for placements through acquisition of professional skills.

2301371L.CEO.4: To support them detect their present level in respect of each Career Development skill and show direction for improvement..

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301371L.CO.1: Relate the importance of Employability Career Development [L2]. 2301371L.CO.2: Build necessary, specific professional skills [L3].

2301371L.CO.3: Analyze the environment of employability [L4].

2301371L.CO.4: Develop various techniques of effective team building in their professional life [L6].

**COURSE ABSTRACT:**

The Employability and Career Development course is designed to enhance students' career readiness and personal growth through practical exercises focused on key aspects of professional development. The course covers self-management skills such as time management and goal setting, essential for personal productivity. Students will engage in personal interviews and group discussions to strengthen their communication abilities and public speaking confidence. Team building and motivational practices are explored to foster collaboration and a positive work environment. Innovative thinking is emphasized to cultivate creativity and adaptability in problem-solving. Additionally, students will learn profile development strategies, including crafting impactful resumes and LinkedIn profiles to enhance their professional online presence. By incorporating aptitude training and a focus on employability, the course aims to equip students with the necessary skills and mindset for success in their careers.

| **SECTION A: Personal Development with the help of Professionals (25 Marks)** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Self Management** | **4 HOURS** |
| Concept of Johari Window,Advantages and disadvantages of every quadrant,Identifying the proportion of each quadrant in respect of self, Using the tools of self-evaluation, self-development and Goal Setting, Stress management, Career anchor. | | |
| **PRACTICAL NO.02** | **Personal Interviews** | **4 HOURS** |
| Preparing for Interviews, Typical expected questions suggested responses, Posture, Body language, Greetings and pleasantries, , Handling unforeseen questions. | | |
| **PRACTICAL NO.03** | **Group Discussion and Public Speaking** | **4 HOURS** |
| Parameters of assessment,Initiating the discussion,Effective listening,Own contribution,Paraphrasing,Arguing and counter-arguing, Giving direction to the discussion, Public Speaking skills. | | |
| **PRACTICAL NO.04** | **Team Building and Motivation** | **4 HOURS** |
| Hallmark of effective teams, Barriers to teamwork, Subjugation of Individual interests for achievement of teams goal, Leading motivating team members. | | |
| **PRACTICAL NO.05** | **Innovative Thinking** | **4 HOURS** |
| Relevance and importance of innovative thinking, Introduction to Brain Storming technique,Collective and individual Brain Storming. | | |
| **PRACTICAL NO.06** | **Proftle Development** | **6 HOURS** |
| Resume Writing: Introduction to the Resume, Key Components of a Resume and Cover Letter, Enhancing tips for Resume and Cover Letter.<br>Letter of recommendation (LOR) preparation: Details on types, samples, structure, content tips format for letters of recommendation for student.<br>Statement of Purpose (SOP) preparation: SOP Formats, Templates, and Guidelines for SOP Writing.<br>Job application and professional email writing. | | |

| SECTION B: | Aptitude Training from Video Based Content and Assessment Platform. (25 Marks) | 30 HOURS |
|---|---|---|

1. Number System
2. HCF LCM , Surds and Indices.
3. Percentages and Average.
4. Time and work.
5. Time, Speed and Distance.
6. Probability.
7. Quadratic Equations.
8. Profit and Loss.
9. Simple and Compound Interest.
10. Ratio and proportion.
11. Permutation and Combination.
12. Boats and Streams, Pipes and Cisterns.
13. Mixtures and Allegations, Mensuration.
14. Data Interpretation – Tables, Pie Charts, Bar Graphs, Line Graphs.

| SECTION C: | Final Assessment with the help of career Assessment Test (25 marks) | 2 HOURS |
|---|---|---|

**TEXT BOOK**


1. J.K.Gangal, A Practical Course in Effective English Speaking Skills, Prentice Hall India Learning Private Limited (2012), ISBN-10: 8120345843.
2. Jean Yates, Practice Makes Perfect: English Conversation, Premium Second Edition, McGraw- Hill Education; 2 edition, ISBN-10: 1259643271.
3. R S Agrawal, Quantitative Aptitude, S. Chand Publishing (2020), ISBN: 9789352534029, 9789352534029.
4. Shakuntala Devi, Puzzles to Puzzle You, Orient Paperbacks, ISBN: 9788122200140, 9788122200140


**REFERENCE BOOK**


1. Stephen Covey: The Seven Habits of Highly Effective People, Simon and Schuster Ltd, ISBN: 0-671-71117-
2. Krishna Mohan, Meera Banerji, Developing Communication Skills, Birla Institute of Technology and Science, ISBN: 033392-919-5.
3. Charles Kepner and Benjamin Tregoe, The Rational Manager: A systematic Approach to Prob- lem Solving and Decision Making , Tata McGraw-Hill Publishing Company Ltd., ISBN:13:978-0070341753.
4. Priyadarshini Patnaik, Group Discussion and Interview Skills , Foundation Books, 1st Ed.- 2011, ISBN No.: 9788175967847, 8175967846.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Major Project - II |
| | COURSE CODE | 2304392L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304392.CEO.1: To equip students with the knowledge and skills necessary to design innovative engineering solutions for complex technical problems.

2304392.CEO.2: To train students in the practical implementation of engineering designs, ensuring they can bring theoretical concepts to life using modern tools and techniques.

2304392.CEO.3: To understand how to create detailed project plans that encompass all stages of implementation, from initial concept to final product.

2304392.CEO.4: To foster students ability to critically evaluate and iterate on their implementations, incorporating feedback and testing results to optimize performance and effectiveness.

2304392.CEO.5: To enhance students communication skills, enabling them to effectively present

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304392.CO.1: Demonstrate proficiency in implementing engineering designs, utilizing modern tools, techniques, and technologies to bring their solutions to fruition [L4].

2304392.CO.2: Conduct rigorous testing and evaluation of implemented solutions, analyzing performance data to ensure that the solutions meet specified requirements and quality stan- dards [L5].

2304392.CO.3: Incorporate ethical considerations and sustainable practices into their implementation processes, evaluating the societal and environmental impacts of their solutions [L3].

2304392.CO.4: Work effectively in multidisciplinary teams, demonstrating strong collaboration, leadership, and project management skills throughout the implementation phases [L3].

**COURSE ABSTRACT:**

The project is most important part of undergraduate curriculum and enables students to develop analyti- cal, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Project Design, Project Implementation and Project Evaluation. After successful completion of project design phase in Sem V (project design), next step is project implementa- tion (Sem VI). The goal of this phase of the project is to implement/develop/experiment/simulate/test the techniques/processes of the project and give a mature shape. The implementation can be a combi- nation of algorithms, techniques, processes, testing etc. This will also include drawing inferences from the results and discussing them.

**GUIDELINES**

1. Preferably project group students of Sem V would be continued in this semester VI.
2. Every project group should consist of minimum 03 and maximum of 04 students.
3. The group members may be from different programs to support the interdisciplinary functioning.
4. Project group members and title of the project need to be approved by Project Guide and School.
5. Projects should preferably have a national/international, industry/academic/research collabora- tion.
6. User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
7. The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.
8. Define proposed solution and apply project management/modeling tools for project planning and design.
9. Define outcome, milestones, definite roadmap for project design, implementation, tools, resources, performance evaluation and documentation.
10. Perform refinement of System architecture & methodology.
11. Students should give a mature shape to their idea in terms of implementation. This is expected in this semester. This may include one or many of these points. Implementation /development/experimentation/simulation/testing/building the techniques/processes

**Collaborative/Sponsored Project**

1. Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for project work.
2. Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization at the start of semester VI.
3. Proposed Collaborative Project work need to be reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of 12 months.
4. Final assessment will be carried out in presence of faculty mentor, external mentor and examiner

**TIMELINE**

1. Freezing of project groups and titles. Refinement of title and objectives from Sem V should freezed by the time of first review.
2. Final Synopsis of the project. (To be done at guide level)
3. Methodology / System Design / Block Diagram should be properly explained by the student
4. Project Review I Presentation.
5. Project Implementation: Students should take the work in one and/more of the points. Like Implementation/development/experimentation/simulation/testing/experimental yield/building the techniques/processes etc. ..
6. Based on the points discussed in 5, student would be able to get results and discuss them. Students should be able to draw inferences from results.
7. Project Review II Presentation.
8. Quality of Publication and Researchers: Students would be educated on different technical papers and their importance (article types, journal metrics etc) along with author/researcher credentials.
9. Project Documentation: Project Report Writing

## ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Project Review I: Problem Statement and objectives, Implementation plan & action (algorithms/techniques/models/mathematical understanding/implementation) (10 Marks)
2. An activity on illustrating methodology. This may inlcude paper reading activity: Read and Summarize a paper in 1 page (Individual to every student of the group). Any other activity can also be taken take would illustrate methodology (10 marks)
3. Project Review II: Results and Implementation, Observations, Inferences, Discussion on algorithms / techniques /models / testing) (10 Marks)
4. Article Quality and Author Credentials: Information about Research Article types, paper quality metrics (SCI/SCOPUS/WOS) and Author Credentials (Citation count, h-index, I10 index etc) (5 marks)
5. Project Report (10 Marks)
6. Project: Documentation Final Presentation and Demonstration (30 Marks)

(Parameters of evaluation: Final implemented work, report, presentation and paper drafted based on work)

## TEXT BOOKS


1. John M. Nicholas. (2012). *Project Management for Engineering, Business and Technology*. 4th Edition, Butterworth-Heinemann. ISBN 978-0080967042.
2. Leslie Lamport. (1994). LaTeX: *A document preparation system, User's guide and reference manual*. 2nd Edition, Addison-Wesley. ISBN 978-0201529838.


## REFERENCE BOOKS


1. Michelle Reid. (2018). *Report Writing (Pocket Study Skills)*. 2nd Edition, Bloomsbury Publish- ing. ISBN 978-0230376557.
2. Sara Efrat Efron and Ruth David. (2018). *Writing the Literature Review : A Practical Guide*. 1st Edition, Guilford Press . ISBN 978-1462536894 .


## E-R ESOURCES

1. e-Yantra: Engineering for better Tomorrow
2. Zotero

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

**SEMESTER: VII INFORMATION TECHNOLOGY (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2308411T | System Design | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 2308421T | Big Data Analytics | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2308422T | Generative AI Applications | | | | | | | | | | |
| | 2308423T | Cloud Native DevOps | | | | | | | | | | |
| | 2308424T | Ethical Hacking & Cyber Laws | | | | | | | | | | |
| | 2308421L | Big Data Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2308422L | Generative AI Applications Lab | | | | | | | | | | |
| | 2308423L | Cloud Native DevOps Lab | | | | | | | | | | |
| | 2308424L | Ethical Hacking & Cyber Laws Lab | | | | | | | | | | |
| MDM | *MDM List | MDM Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| HSSM MEC | 2308476T | Infrastructure Management | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2308491L | Major Project - III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC PRJ | 2308492T | Research Methodology | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC SI | 2308496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| **TOTAL** | | | **13** | **6** | **-** | | | | | | **750** | **20** |

**SEMESTER: VIII INFORMATION TECHNOLOGY (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2308412T | Cyber Security | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 230842XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 23XXSWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| MDM | *MDM List | MDM Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 23XXSWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| OE | 2308451 | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2308497L | Semester-Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 2308498L | Semester Exchange | - | - | - | - | - | - | | | | |
| | 2308493L | Capstone Portfolio | - | - | - | - | - | - | | | | |
| **TOTAL** | | | **10** | **4** | | | | | | | **725** | **20** |

*Credits earned in advance through a credit transfer scheme

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP) | | |
|---|---|---|---|
| INFORMATION TECHNOLOGY | W. E. F. | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY) | RELEASE DATE | : | |
| | REVISION NO. | : | |

**SEMESTER: VII INFORMATION TECHNOLOGY (PART B)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2308411T | System Design | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| MDM | *MDM List | Multidisciplinary Minor Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2308491L | Major Project - III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2308499L | Industry Practicum | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| ELC SI | 2308496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| **TOTAL** | | | **6** | **4** | **-** | | | | | | **750** | **20** |

**SEMESTER: VIII INFORMATION TECHNOLOGY (PART B)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2308412T | Cyber Security | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 230842XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2308SWXX | SWAYAM Course* (PEC) | - | - | - | 25 | - | 75 | - | - | | |
| MDM | *MDM List | MDM Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 23XXSWXX | SWAYAM Course* (MDM) | - | - | - | 25 | | 75 | - | - | | |
| OE | 2308451L | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2308497L | Semester-Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 2308498L | Semester Exchange | - | - | - | - | - | - | | | | |
| | 2308493L | Capstone Portfolio | - | - | - | - | - | - | | | | |
| **TOTAL** | | | **10** | **4** | | | | | | | **725** | **20** |

*Credits earned in advance through a credit transfer

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | SYSTEM DESIGN |
| | COURSE CODE | 2304411T |
| | COURSE CREDITS | 4 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 4 | NIL | 60 | NIL | 90 | NIL | NIL | 150 |

**PREREQUISITE : Software Engineering**

**COURSE OBJECTIVES :**

2304411T.CEO.1: 1.To Introduce the fundamental principles of system design, architectural styles, and system types used in modeling real-world applications. .

2304411T.CEO.2: To impart an understanding of human-computer interaction and usability principles to ensure system designs meet user needs effectively.

2304411T.CEO.3: To familiarize with the design process and interaction styles through contextual inquiry and iterative refinement.

2304411T.CEO.4: To explore key concerns in secure, accessible, and ethically responsible system design

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304411T.CO.1: Analyze system design principles to model real-world applications using appropriate architectural styles, system types, and modeling tools.[L4]

2304411T.CO.2: Apply human-computer interaction principles and usability heuristics for effective and user-friendly interfaces for responsive systems.[L3]

2304411T.CO.3: Identify interactive system components using contextual inquiry, iterative design, and interaction styles .[L3]

2304411T.CO.4: Evaluate system designs for security, accessibility, and ethical compliance.[L5]

**COURSE ABSTRACT:**

System Design introduces students to the principles and practices involved in designing scalable, reliable, and user-centered software systems. It covers the end-to-end design process from high-level architecture to low-level component design while integrating essential concepts from Human-Computer Interaction and UI/UX design.The course prepares students to design modern software systems that are not only efficient and robust, but also accessible and user-friendly.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION TO SYSTEM DESIGN & MODELING CENTERED NEEDS** | **10 HOURS** |

**Applications/Case Study:** Online Course Management System,Ride-Sharing App (like Uber),Smart Home Automation System.

**Contents:** Definition and characteristics of system design, Types of systems: Monolithic, Dis- tributed, Microservices, Design considerations: Scalability, reliability, availability, fault tolerance, maintainability, Architectural styles: Layered, Client-server, Microservices, Event-driven, Communi- cation protocols: REST vs WebSockets ,Requirement gathering and UML Modeling.

**Self Study:** Event-Driven Architecture-Role of asynchronous communication,Event sourcing vs. traditional CRUD models.

**Further readings:** Domain-Driven Design (DDD) – Strategic Concepts, Ubiquitous language, Bounded contexts.

| | | |
|---|---|---|
| **UNIT 2** | **USABILITY DESIGN** | **10 HOURS** |

**Applications/Case Study:** Online Food Delivery Platform, E-commerce Website,Messaging App(WhatsApp).

**Contents:**Human-Computer Interaction:Importance,Role, Human Factors in system design :Cognitive and Physical, Ergonomics, Usability, User Interface (UI) principles , Bridging Requirements with UX design:User-centered insights, High Level Design: Performance and Maintainability, Interaction Models in Architecture: Norman's Action Cycle & Gulf of Execution/Evaluation, Aligning system flow with user tasks and feedback loops,Shneiderman's Eight Golden Rules for Interface Design,UI behavior under different architectural choices (real-time vs batch).

**Self Study:** Psychology and the design of Interactive Systems.

**Further Readings:**Agent based Interfaces.

| UNIT 3 | DESIGN PROCESS AND INTERACTION STYLES | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Travel Booking System(MakeMyTrip),Inventory Management UI, Dashboard for IoT Data.

**Contents:** Four Pillars of Design, Process of Design, Ethnographic Observations, ContextualInquiry, Iterative Design, Participatory Design, Navigation Design, Visual Design: Layout, Color,Fonts, Labeling,Scenarios,Interaction Styles:Direct Manipulation, Menu Selection, Form-Filling, Commands, Nat- ural Language, Internationalization, Interaction Design Patterns,HCI in software process: interactive systems and SDLC.

**Self Study:** GOMS(Goals, Operators, Methods, and Selection rules) Keystroke-Level Model:Efficiency in interface actions.

**Further Readings:** Responsive and Adaptive UI Design, UI structure adaptation across devices(desktop, mobile, kiosk).

| UNIT 4 | PERFORMANCE, SCALABILITY AND USABILITY EVALU- ATION | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Case Study on Live Quiz App,Election Result Dashboard.

**Contents:** System Performance, Scalability-Horizontal vs vertical scaling,load balancing, Content Delivery Network and edge computing for faster content delivery, Caching strategies for UI respon- siveness (front-end and back-end), Performance bottlenecks: detection and profiling, Evaluation: Heuristic Evaluation, Cognitive Walkthrough, Expert Reviews, User Surveys, Think Aloud, A/B testing, heatmaps, analytics.

**Self Study:** Case Studies of High-performance systems with good/bad UX.

**Further readings:** Information Architecture.

| UNIT 5 | Security, Accessibility, and Ethical Design in Systems | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Healthcare Portal (HIPAA-compliant system)-Secure UI and audit logging,Social Media Platform-Analysis of ethical concerns (privacy, addiction, content surfacing), Government Service Portal- Accessibility audit and improvement plan

**Contents:** Authentication and Authorization (OAuth2, JWT), Secure UI design (password inputs, feedback handling), Data privacy principles (PII, GDPR, HIPAA), Accessibility in System Design: Importance of inclusive design, WCAG principles (Perceivable, Operable, Understandable, Robust), Designing for diverse user needs (visual, motor, cognitive impairments), Ethics and ResponsibleDesign: Dark patterns vs user-centered design, Designing for transparency and informed consent, Data ethics: What not to collect, when not to personalize etc.

**Self Study:** Common Web Security Vulnerabilities.

**Further Readings:** AI and Ethics in Personalization.

| UNIT 6 | PROTOTYPE DESIGN | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Low Level Design for a Ride-Sharing App Uber/Ola, Chat Application.

**Contents:** Common design patterns (Factory, Singleton, Observer), Connecting UI flows to system functions (LLD-to-UI mapping) , frontend–backend integration principles, state management in UI applications including Redux and Context API, SOLID principles in UI and backend service design.

**Self Study:** Job Scheduling System (e.g., Cron, Airflow): Design classes and interactions.
**Further Readings:** Patterns for Effective Interaction Design.

**TEXT BOOKS**


1. Alen Dix,Janet Finlay,Human Computer Interaction,4th Edition,Pearson Publication,ISBN 0130461091
2. Grady Booch, James Rumbaugh, and Ivar Jacobson,The Unified Modeling Language User Guide,Addison Wesley,ISBN 978-0134852157
3. Martin Kleppmann, Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems,O'Reilly
4. Richard N. Taylor, Nenad Medvidovic, Eric Dashofy Software Architecture: Foundations, Theory, and Practice,Wiley,978-0470167748
5. Alex Xu,System Design Interview:An Insider's Guide (Vol 1&2),Publisher:Shroff/bytebytego,979-8664653403


**REFERENCE BOOKS**


1. Kent Norman, JurekKirakowski, Handbook of Human Computer Interaction" Wiley Publication,ISBN 9781118976135
2. Martin L. Abbott ,Michael T. Fisher, The Art of Scalability-Scalable Web Architecture, Processes,and Organizations for the Modern Enterprise,Addison Wesely 978-0-13-403280-1.
3. Sam Newman, Building microservices.O'Reilly, ISBN 9789391043384
4. Nick Rozanski Eóin Woods,Software Systems Architecture,ISBN - 978-8131726136
5. Allen I. Hollub, Compiler Design in C, PHI, 2015. ISBN: 978-93-325-4950-0
6. Helen Sharp, Jenifer Preece Interaction Design beyond Human Computer Interaction" 5th Edition, ISBN 978-1119547259
7. Donald Norman, The Design of Everyday Things", 2002 Edition, Basic Books, ISBN 100- 465067107
8. Wilbert O. Galitz,The Essential Guide to User Interface Design, 2nd Edition, Wiley-dreamtech India (P) Ltd., ISBN 81-265-0280-0.


**E-RESOURCES**

1. Microservices *blog.dreamfactory.com/microservices-examples*
2. Architectural Blueprints: The 4+1 View Model of Software Architecture *https://arxiv.org/abs/2006.04975*
3. Models and Techniques for Ensuring Reliability, Safety, Availability, and Security *https://arxiv.org/pdf/1106.5576*

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Big Data Analytics |
| | COURSE CODE | 2304421T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE :** Requires knowledge of Descriptive Analytics, Predictive Analytics

**COURSE OBJECTIVES :**

2304421T.CEO.1: To discuss the significance of big data technologies in data-driven world.

2304421T.CEO.2: To demonstrate usage of big data analytical tools and Map reduce, Apache Spark frameworks.

2304421T.CEO.3: To examine case studies that illustrate big data analytics applications in the health-care, finance, retail domain

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304421T.CO.1: Demonstrate Big Data technologies and Hadoop ecosystem components [L3].

2304421T.CO.2: Apply big data concepts, architectures, and frameworks to solve large-scale data problems. [L3].

2304421T.CO.3: Apply big data technologies, including Pig, Hive, and Apache Spark, to analyze large-scale datasets.[L3].

2304421T.CO.4: Analyze real-world case studies and select appropriate big data tools and frameworks for their resolution.[L4].

**COURSE ABSTRACT:**

This course on Big Data Analytics provides a comprehensive overview of the principles, technologies, and tools used to manage, analyze, and visualize large datasets. Students will explore the characteristics of big data, including its volume, velocity, variety, veracity, and value. Through hands-on projects and real-world case studies, participants will gain experience using popular big data technologies such as Hadoop, Hive, Apache Spark, and NoSQL databases like Habse. By the end of the course, students will be equipped with the skills and knowledge necessary to apply big data analytics in various industries, enabling them to make data-driven decisions

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction To Big Data And Hadoop** | **08 HOURS** |

**Applications/Case Study:** Healthcare Monitoring and cause Detection

**Contents:** Introduction to Big Data, Sources of Big Data, 5 V's of Big Data, Big Data Analyt- ics, Challenges of Traditional System, Challenges of Big data, Distributed Systems, Introduction to Apache Hadoop, Hadoop Features, Components of Hadoop Ecosystem, Hadoop Architecture, Commercial Hadoop Distributions.

**Self Study:** Environmental Setup and Custer management of Hadoop

**Further Readings:** Hadoop Security Architecture .

| | | |
|---|---|---|
| **UNIT 2** | **HDFS (Hadoop Distributed File System)** | **06 HOURS** |

**Applications/Case Study:** Retail Analytics with HDFS.

**Contents:** Introduction to HDFS, Features and Goals, Internal Architecture and HDFS Workflow, HDFS Concepts, Command Line Interface (CLI), Hadoop file system interfaces, HDFS File Operations, YARN Components, Benefits of YARN,Data flow, Data Ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: Compression, Serialization - Avro, parquet, File-Based Data structures.

**Self Study:** Performance Evaluation in HDFS.

**Further Readings:** HDFS architecture in cloud computing.

| | | |
|---|---|---|
| **UNIT 3** | **Map Reduce Framework** | **06 HOURS** |

**Applications/Case Study:** Search: Web Indexing.

**Contents:** Introduction to MapReduce, Framework, Compilation and Execution Process Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map-Reduce Types and Formats, Map Reduce Features. MapReduce Use Cases. Input Splits, Relation between Input Splits and HDFS Blocks Combiner Practitioner.

**Self Study:** Map Reduce versus Spark.

**Further Readings:** Map reduce in Cloud Computing.

| UNIT 4 | Apache Pig and Hive | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Sentiment Analysis on social media.

**Contents: Apache Pig -** Introduction to PIG, Execution Modes of Pig, Pig-Latin Grunt, Pig data types, Load and Store operations. The Pig operators- Diagnostics Operators, Data Processing oper- ators, Relational Operators, Group Operator, Joins, Union in Pig, Built In Functions (Eval, Math, String, Date).

**Apache Hive -** Introduction to Hive, Hive Shell, Hive Services, Hive Metastore, Hive DDL and DML, Hive Databases, creating new table, Basics and Internal Table, external table, Loading Different File Formats, Load Data Into Hive Table, Hive Indexes and View, Hive Partitions Buckets, Hive Function Built-in User Defined Functions.

HiveQL: Simple Operations On Hive Table, query operations on hive table, Querying Complex Struc- tures From A Table, Join Sub-Query.

**Self Study:** Difference between Pig and Hive. Technology Comparison with Traditional Databases.

**Further Readings:** Hive ETL

| UNIT 5 | Hadoop Databses - Apache HBase, Cassandra, CouchDB | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Financial Services Analytics with HBase.

**Contents:** Apache HBase: Introduction, Concepts, HBase Vs RDBMS, HBase prerequisites, Base Architecture, Components, and Data Model, HBase Shell Commands, HBase Table operations, Create, Insert Retrieve Data in HBase, Using Apache HBase Shell, Conceptual Physical View, Name-space, Tables, Rows, Cells Column Family, Sort Order, Column Metadata, joins, ACID, Schema Design,Row Key design,Constraints,Catalog Tables, Storing Medium-sized Objects, Backup and Restore commands. Introduction to Cassandra, CouchDB.

**Self Study:** NoSQL Databases

**Further Readings:** NoSQL Databases integration in cloud technology.

| UNIT 6 | Apache Spark | 09 HOURS |
|---|---|---|

**Applications/Case Study:** Recommender systems.

**Contents:** Introduction, Spark Architecture, Spark Cluster Architecture, Spark Master and Worker node Service, Spark DAG, Spark Executor Spark core programming concepts, compilation and execution of spark program. Resilient distributed databases (RDD),

Introduction to Spark Data Frames, Data Frames Overview, Spark Data Frame Operations, Group By and Aggregate Functions, Missing data, Date and Timestamps.

**Self Study:** Hadoop MapReduce Vs Apache Spark.

**Further Readings:** Mobile big data analysis using Apache Spark.

**TEXT BOOKS**


1. DT Editorial Services. (2016). *Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization*. 1st Edition, Dreamtech Press. ISBN: 978-8184891430.
2. Tom White.(2016). *Hadoop: The Definitive Guide*. 4th Edition, O'Reilly. ISBN: 978-9352130672.
3. Lars George. (2011). *HBase: The Definitive Guide - Random Access to Your Planet-Size Data*. 1st Greyscale Indian Edition, O'Reilly. ISBN:978-9350235034.
4. Bill Chambers.(2018). *Spark: The Definitive Guide - Big Data Processing Made Simple* . 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9352137060.


**REFERENCE BOOKS**


1. Dipak Vohra (2016). *Practical Hadoop Ecosystem:A Definitive Guide to Hadoop Frameworks and Tool*. 1st Edition, A-Press, ISBN: 978-1484221983.
2. Arshdeep Bahga, Vijay Madisetti. (2016). *Big Data Science Analytics: A Hands-On Approach*. 1st Edition, VPT, ISBN: 978-0996025546.
3. Vaddeman, Balaswamy. (2018). *Beginning Apache Pig*. 1st Berkeley, CA: Apress. ISBN: 978-1484223369.
4. Holden Karau, Rachel Warren. (2017). *Beginning Apache Pig*. 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9352135615.
5. Mamta Mittal , Valentina E. Balas , Lalit Mohan Goyal, Raghvendra Kumar. (2018). *Big data processing using spark in cloud* . 1st Edition, Springer Verlag, ISBN: 978-9811344480


**E-R ESOURCES**

1. https://hadoop.apache.org/docs/stable/
2. https://nptel.ac.in/courses/106104189

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | Big Data Analytics Lab |
| | **COURSE CODE** | 2304421L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Requires knowledge of Descriptive Analytics, Predictive Analytics

**COURSE OBJECTIVES :**

2304421L.CEO.1: To explore the significance of big data technologies in data-driven world.

2304421L.CEO.2: To demonstrate usage of Bigdata frameworks Map reduce, Apache Spark to perform analytics over large datasets.

2304421L.CEO.3: To illustrate usage of analytical tools and ecosystem componemts like Pig, Hive, Hbase etc.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304421L.CO.1: Apply big data tools and frameworks (e.g., Hadoop, Map Reduce, Spark) to process large datasets. [L3].

2304421L.CO.2: Analyze large datasets using technologies pig, hive, Apache spark, etc.[L4].

2304421L.CO.3: Evaluate real-world case studies using big data implementations. [L5].

2304421L.CO.4: Develop visualization and dashboards to interpret and communicate analytical results effectively [L3].

**COURSE ABSTRACT:**

This course on Big Data Analytics provides a comprehensive overview of the principles, technologies, and tools used to manage, analyze, and visualize large datasets. Students will explore the characteristics of big data, including its volume, velocity, variety, veracity, and value. Through hands-on projects and real-world case studies, participants will gain experience using popular big data technologies such as Hadoop, Hive, Apache Spark, and NoSQL databases like Habse. By the end of the course, students will be equipped with the skills and knowledge necessary to apply big data analytics in various industries, enabling them to make data-driven decisions.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Hadoop Installation and Commands** | **4 HOURS** |
| A. Installation of the Hadoop under windows 10/ Linux (Min. 2 GBRAM)/ Virtual Machines or Hadoop Distribution of Cloudera (Min Requirement 8 GB RAM)<br>B. Execution of basic Hadoop Commands | | |
| **PRACTICAL NO.02** | **Map Reduce Framework** | **4 HOURS** |
| Implementation of Word Count program using Map Reduce Framework. | | |
| **PRACTICAL NO.03** | **Apache Pig** | **4 HOURS** |
| Apache PIG exercises using Given dataset Create two file as fil11.txt and file2.txt, Insert students details (least 10 records) like (rollno, name, age, city, etc) but not limited to, and perform following operations<br>1. Load the files using PigStorage<br>2. Perform task using Diagnostic Operator - Dump operator,Describe operator,Explain operator, Illustration operator<br>3. Grouping and Joining - Group Operator, Cogroup Operator, Join Operator,Cross Operator<br>4. Combining Splitting - Union Operator, Split Operator<br>5. Filtering - Filter Operator, Distinct Operator, Foreach Operator<br>6. Sorting - Order By, Limit Operator<br>7. Built-in Functions | | |
| **PRACTICAL NO.04** | **Apache Hive** | **4 HOURS** |
| Apache Hive: DDL, DML Statement using Apache Hive Execution of Given Queries on various dataset. | | |
| **PRACTICAL NO.05** | **Apache HBase** | **4 HOURS** |
| Apache HBase: DDL, DML Operations, HBase Operations- read and Write using Metatable. | | |
| **PRACTICAL NO.06** | **Apache Spark** | **4 HOURS** |
| Social Media (Facebook/witter) Analysis using Spark. | | |
| **MINI PROJECTS** | **For Practical Exam** | **6 HOURS** |
| Students need to complete mini project which will be evaluated under Practical Exam. | | |

**TEXT BOOKS**


1. DT Editorial Services. (2016). *Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization*. 1st Edition, Dreamtech Press. ISBN: 978-8184891430.
2. Tom White.(2016). *Hadoop: The Definitive Guide*. 4th Edition, O'Reilly. ISBN: 978-9352130672.
3. Lars George. (2011). *HBase: The Definitive Guide - Random Access to Your Planet-Size Data*. 1st Greyscale Indian Edition, O'Reilly. ISBN:978-9350235034.
4. Bill Chambers.(2018). *Spark: The Definitive Guide - Big Data Processing Made Simple* . 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9352137060.


**REFERENCE BOOKS**


1. Dipak Vohra (2016). *Practical Hadoop Ecosystem:A Definitive Guide to Hadoop Frameworks and Tool*. 1st Edition, A-Press, ISBN: 978-1484221983.
2. Arshdeep Bahga, Vijay Madisetti. (2016). *Big Data Science Analytics: A Hands-On Approach*. 1st Edition, VPT, ISBN: 978-0996025546.
3. Vaddeman, Balaswamy. (2018). *Beginning Apache Pig*. 1st Berkeley, CA: Apress. ISBN: 978-1484223369.
4. Holden Karau, Rachel Warren. (2017). *Beginning Apache Pig*. 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9352135615.
5. Mamta Mittal , Valentina E. Balas , Lalit Mohan Goyal, Raghvendra Kumar. (2018). *Big data processing using spark in cloud* . 1st Edition, Springer Verlag, ISBN: 978-9811344480


**E-R ESOURCES**

1. https://hadoop.apache.org/docs/stable/
2. https://nptel.ac.in/courses/106104189

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Generative Artificial Intelligence |
| | COURSE CODE | 2304422T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Machine Learning, Deep Learning.

**COURSE OBJECTIVES :**

2304422T.CEO.1: Understand principles of generative models.
2304422T.CEO.2: Develop practical skills in building and deploying generative AI models.
2304422T.CEO.3: Analyze ethical considerations and impacts of generative AI in different fields.
2304422T.CEO.4: Explore advanced models such as GANs, VAEs, Diffusion Models, and Transformer-based architectures.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304422T.CO.1: Develop Generative AI models and diffusion models to generate data across various domains like images, text, and music [L3].
2304422T.CO.2: Use industry-standard tools and platforms for building, deploying, and scaling generative AI models [L3].
2304422T.CO.3: Analyze the performance of Generative AI models for real world applications [L4].
2304422T.CO.4: Determine the ethical challenges posed by generative AI technologies, including bias, misinformation, and intellectual property concerns [L5].

**COURSE ABSTRACT:**

This advanced course in Generative AI explores the theoretical underpinnings and practical implementations of AI models capable of generating original content. Leveraging foundational knowledge from Artificial Intelligence and Machine Learning and Deep Learning, students will delve into the architec- ture, training, and application of generative models, including Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Transformer-based models such as GPT.

Through hands-on projects and case studies, students will learn to design, implement, and evaluate generative models for tasks such as image synthesis, text generation, and style transfer. Emphasis is placed on understanding the ethical implications and potential biases of generative AI, as well as methods to mitigate risks in applications. By the end of the course, students will have practical expertise in deploying generative models and insights into emerging applications across industries.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Generative AI** | **08 HOURS** |

**Applications/Case Study:** AI-Generated Music:Open AI's Jukebox, Text Generation:AI Dungeon **Contents:** Overview of AI and generative models. Difference between discriminative and generative models. Applications of generative models (art, music, image generation, etc.). Historical context of generative models. Large Language Models.

**Further Readings:** Interactive Generative Systems

| | | |
|---|---|---|
| **UNIT 2** | **Autoencoders and Variational Autoencoders (VAE)** | **09 HOURS** |

**Applications/Case Study:** Medical Imaging, Anomaly Detection, Customer Segmentation and Recommendations

**Contents:** Introduction to Autoencoders (AE): Encoder, Decoder, Applications (Data Compression, Denoising). Variational Autoencoders (VAE): KL divergence, reparameterization trick, latent space exploration.

**Self Study:** Limitations of AEs and VAEs (overfitting, interpretability)

| | | |
|---|---|---|
| **UNIT 3** | **Generative Adversarial Networks (GANs)** | **08 HOURS** |

**Applications/Case Study:** Synthetic Medical Imaging Data, Deepfake Creation and Detection. **Contents:** Introduction to GANs: Generator and Discriminator structure, Adversarial loss, Minimax optimization. Types of GANs: Vanilla GAN, Deep Convolutional GANs (DCGAN), Conditional GANs, Progressive Growing GAN. Challenges in GAN Training: Mode collapse, vanishing gradients.

**Further Readings:** Style Transfer and Creativity in Design: StyleGAN, CycleGAN

| UNIT 4 | Transformer-based Generative Models | 08 HOURS |
|---|---|---|

**Applications/Case Study:** OpenAI GPT-3, DALL-E and DALL-E 2, BERT.

**Contents:** Introduction to Transformers: Self-attention mechanism, Positional encoding. Transformer-based Generative Models: GPT (GPT-2, GPT-3), BERT for generative tasks. Text-to- Image Synthesis, Vision Transformers (ViT) and generative applications in image generation.

**Further Readings:** Creative Industries: Content Creation in Art, Music, and Design.

| UNIT 5 | Diffusion Models | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Medical Imaging Enhancement, Automotive Design and Simulation

**Contents:** Introduction to Denoising Diffusion Probabilistic Models (DDPM). Producing high-quality, diverse outputs in image, video, and text generation

Iterative and probabilistic approach: Forward diffusion (adding noise) and reverse process (denoising)

**Self Study:** Multimodal Models

| UNIT 6 | Ethical, Societal, and Legal Dimensions of Generative AI | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Medical Imaging Enhancement, Automotive Design and Simulation

**Contents: Ethics:** Fairness, transparency, accountability, bias mitigation, privacy, and human-AI collaboration in global and Indian contexts.

**Society:** Misinformation, job displacement, cultural diversity, trust restoration, and applications in education and healthcare worldwide and in India.

**Policy Law:** EU AI Act, General Data Protection Regulation, India's IT Act, Data Protection Bill, copyright, intellectual property, liability, and AI governance frameworks.

**Security Sustainability:** Deepfakes, misuse prevention, energy efficiency, carbon footprint, Paris Agreement, and National AI Strategy (NITI Aayog).

**TEXT BOOKS**


1. Jozefowicz, R., Zaremba, W., Sutskever, I. (2023). An Introduction to Generative Models with Applications. Cambridge University Press.
2. Choi, H., Kim, J. (2023). Generative AI: A Practical Guide to Applications and Ethics. Springer.
3. Liu, L., Xu, H. (2020). Generative deep learning: Teaching machines to paint, write, compose, and play. O'Reilly Media.
4. Goodfellow, I., Bengio, Y., Courville, A. (2016). Deep learning. MIT Press. https://www.deeplearningbook.org/

**REFERENCE BOOKS**


1. Ramesh, A., Pavlov, M., Goh, G., et al. (2022). DALL•E: Creating images from text. OpenAI. Retrieved from https://openai.com/research/dall-e
2. Lee, J., Kim, J. (2023). Generative AI for Software Engineering: Techniques and Tools. CRC Press.


**E-LEARNING RESOURCES**


1. Swayam Course on Generative AI and Large Language Models, By Naveen Kumar Bhansali, Indian Institute of Management Bangalore (IIMB).
2. OpenAI. (n.d.). Research and blog on AI advancements. Retrieved from https://www.openai.com/blog.
3. Coursera. (n.d.). Generative adversarial networks (GANs) specialization by DeepLearning.AI. Coursera. Retrieved from https://www.coursera.org

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | Generative Artificial Intelligence LAB |
| | **COURSE CODE** | 2304422L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Machine Learning, Deep Learning.

**COURSE OBJECTIVES :**

2304422L.CEO.1: Develop practical skills in building and deploying generative AI models.
2304422L.CEO.2: Analyze ethical considerations and impacts of generative AI in different fields.
2304422L.CEO.3: Explore advanced models such as Generative Adversarial Networks , Variational Autoencoders, Diffusion Models, and Transformer-based architectures.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304422L.CO.1: Analyze Generative AI models and diffusion models to generate data across various domains like images, text, and music [L4].
2304422L.CO.2: Evaluate the performance of Generative AI models for real world applications [L5].
2304422L.CO.3: Deploy generative AI for practical applications such as image synthesis, data augmentation, and creative content generation [L6].

**COURSE ABSTRACT:**

This advanced course in Generative AI explores the theoretical underpinnings and practical implementations of AI models capable of generating original content. Leveraging foundational knowledge from Artificial Intelligence and Machine Learning and Deep Learning, students will delve into the architec- ture, training, and application of generative models, including Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Transformer-based models such as GPT.

Through hands-on projects and case studies, students will learn to design, implement, and evaluate generative models for tasks such as image synthesis, text generation, and style transfer. Emphasis is placed on understanding the ethical implications and potential biases of generative AI, as well as methods to mitigate risks in applications. By the end of the course, students will have practical expertise in deploying generative models and insights into emerging applications across industries.

**PRACTICAL EXPERIMENTS**

| | | |
|---|---|---|
| **PRACT 1** | **Introduction to Generative AI** | **04 HOURS** |

**Practical Experiment:**

1. Setting Up the Environment for Generative AI and Make use of generative models for creative content generation.
2. Implement simple probabilistic models like Gaussian Mixture Models.

| | | |
|---|---|---|
| **PRACT 2** | **Autoencoders and Variational Autoencoders (VAE)** | **04 HOURS** |

**Practical Experiment**

1. Build a simple AE model for Dimensionality Reduction and Denoising.
2. Generate realistic faces or interpolate between facial features for creative applications in entertainment and design using VAE.

| | | |
|---|---|---|
| **PRACT 3** | **Generative Adversarial Networks (GANs)** | **04 HOURS** |

**Practical Experiment:** Implement a DCGAN and/or cGAN on a chosen dataset to generate original image data, providing a comprehensive summary of the GAN architectures, training processes, and generated results. Conduct a comparative analysis of the models, evaluating their effectiveness in image quality and consistency. Conclude with a presentation that includes a case study analysis, discussing ethical considerations and challenges in real-world GAN applications.

| | | |
|---|---|---|
| **PRACT 4** | **Transformer-based Generative Models** | **04 HOURS** |

**Practical Experiment:**

1. Generate coherent and contextually relevant text using GPT models.
2. Create images based on text prompts using a text-to-image model to explore Transformer capa- bilities in multimodal tasks.

| PRACT 5 | Diffusion Models | 04 HOURS |
|---|---|---|
| **Practical Experiment:** Implement a basic diffusion model for image generation by simulating the process of adding and removing noise. Use a pre-trained diffusion model to generate images from text prompts and compare results, highlighting model strengths, limitations, and ethical considerations. | | |
| **PRACT 6** | **Generative AI in Action: The Capstone Experience** | **10 HOURS** |
| This Lab Experiment serves as the culmination of the Generative AI course, where students apply their acquired knowledge and skills to develop a capstone project that demonstrates innovative use of generative models. Students will work in teams to ideate, design, and implement a project that addresses a real-world challenge or explores a creative application of generative AI. Learning Outcomes:<br>1. Formulate a project proposal based on identified needs or creative ideas in the field of Gen AI.<br>2. Collaborate effectively in teams to execute a Gen AI project.<br>3. Implement, Analyze and Evaluate a Gen AI model using appropriate methodologies and tools.<br>4. Communicate project outcomes through a detailed report/article and a professional presentation. | | |

**TEXT BOOKS**


1. Jozefowicz, R., Zaremba, W., Sutskever, I. (2023). An Introduction to Generative Models with Applications. Cambridge University Press.
2. Choi, H., Kim, J. (2023). Generative AI: A Practical Guide to Applications and Ethics. Springer.
3. Liu, L., Xu, H. (2020). Generative deep learning: Teaching machines to paint, write, compose, and play. O'Reilly Media.
4. Goodfellow, I., Bengio, Y., Courville, A. (2016). Deep learning. MIT Press. https://www.deeplearningbook.org/


**REFERENCE BOOKS**


1. Ramesh, A., Pavlov, M., Goh, G., et al. (2022). DALL•E: Creating images from text. OpenAI. Retrieved from https://openai.com/research/dall-e
2. Lee, J., Kim, J. (2023). Generative AI for Software Engineering: Techniques and Tools. CRC Press.


**E-LEARNING RESOURCES**

1. Swayam Course on Generative AI and Large Language Models, By Naveen Kumar Bhansali, Indian Institute of Management Bangalore (IIMB).
2. OpenAI. (n.d.). Research and blog on AI advancements. Retrieved from https://www.openai.com/blog.
3. Coursera. (n.d.). Generative adversarial networks (GANs) specialization by DeepLearning.AI. Coursera. Retrieved from https://www.coursera.org

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | CLOUD NATIVE DEVOPS |
| | **COURSE CODE** | 2304423T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE :** Requires knowledge of Cloud Computing Foundations Cloud Native Application Development

**~~COURSE OBJECTIVES :~~**

2304423T.CEO.1: To explain the historical development of DevOps, and focusing on its role in bridging the gap between development and operations teams.

2304423T.CEO.2: To guide students in understanding the architecture, fundamental concepts, and essential components of Ansible.

2304423T.CEO.3: To equip students with the skills to build, manage, and deploy Docker containers

2304423T.CEO.4: To prepare students to set up and configure a Kubernetes cluster on AWS

2304423T.CEO.5: To train students to monitor and troubleshoot CI/CD pipelines in Jenkins.

2304423T.CEO.6: To develop students' ability to write Terraform configuration files

**~~COURSE OUTCOMES :~~**

After successful completion of the course, students will be able to,

2304423T.CO.1: Describe the benefits of adopting DevOps practices in development.[L2] 2304423T.CO.2: Apply Ansible's automation of system configuration and deployment.[L3] 2304423T.CO.3: Deploy scalable, available containerized applications on AWS.[L3]

2304423T.CO.4: Analyze the architecture and components of Kubernetes within an AWS environment.[L4]

2304423T.CO.5: Evaluate CI/CD pipelines in Jenkins for software workflows.[L5]

2304423T.CO.6: Analyze the Terraform configuration files within an AWS environment.[L4]

**COURSE ABSTRACT:**

The Cloud Native DevOps course provides an in-depth exploration of modern development and operational practices designed for cloud-native environments. It covers key concepts, tools, and methodologies such as containerization, microservices, CI/CD pipelines, infrastructure as code, and observability. Par- ticipants will learn to build, deploy, and manage scalable, resilient, and automated applications using platforms like Kubernetes, Docker, and cloud services (e.g., AWS). Emphasizing hands-on learning, the course equips learners with skills to streamline workflows, optimize performance.andfostercollaboration between development and operations teams, ensuring robust

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Devops** | **07 HOURS** |

**Applications/Case Study:** Tech Solutions

**Contents:** DevOps: Introduction, Features, Architecture, Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI/CD.

**Self Study:** DevOps vs Traditional IT Practices

**Further Readings:** DevOps Case Studies.

| | | |
|---|---|---|
| **UNIT 2** | **Conftguration Management: Ansible** | **08 HOURS** |

**Applications/Case Study:** FinTechCorp

**Contents:** Introduction to Ansible and Configuration Management, Ansible Inventory and Ad-Hoc Commands, Writing Ansible Playbooks, Advanced Playbook Features, Roles, and Best Practices

**Self Study:**Ansible Architecture.

**Further Readings:**Ansible in CI/CD Pipelines.

| | | |
|---|---|---|
| **UNIT 3** | **Containerization : Docker** | **08 HOURS** |

**Applications/Case Study:** CloudApps Inc.

**Contents:** Introduction to Docker and Containers, Working with Docker Images and Dockerfile, Docker Compose and Multi-Container Applications, Docker on AWS (ECS, ECR, and Fargate), Container Orchestration and Scaling with AWS ECS and Fargate, Docker Security and Best Practices in AWS.

**Self Study:** Docker Architecture.

**Further Readings:**Docker Monitoring and Logging.

| UNIT 4 | Kubernetes | 07 HOURS |
|---|---|---|
| **Applications/Case Study:** AppTech Solutions<br>**Contents:** Introduction to Kubernetes and AWS EKS, Kubernetes architecture, Core Kubernetes Concepts and Networking in AWS EKS, Storage, Monitoring, and Logging in Kubernetes on AWS, Security, Scaling, and Best Practices in AWS EKS.<br>**Self Study:** Kubernetes Configuration Management<br>**Further Readings:**Advanced Kubernetes Features | | |
| **UNIT 5** | **CI/CD using Jenkins** | **07 HOURS** |
| **Applications/Case Study:** RetailTech Solutions<br>**Contents:** Introduction to CI/CD and Jenkins Basics, Jenkins Job Configuration and Pipeline Creation, Advanced Jenkins Pipelines and Integration with Tools, Continuous Deployment and Best Practices.<br>**Self Study:** Building and Testing with Jenkins.<br>**Further Readings:** Security in Jenkins. | | |
| **UNIT 6** | **Resource provisioning using Terraform** | **08 HOURS** |
| **Applications/Case Study:** CloudServe Inc.<br>**Contents:** Introduction to Infrastructure as Code (IaC) and Terraform Basics, Building AWS Infrastructure with Terraform, Advanced Terraform Features and AWS Resource Provisioning, Terraform Best Practices, Automation, and Security.<br>**Self Study:** State Management in Terraform.<br>**Further Readings:** Terraform Testing and Validation. | | |

**TEXT BOOKS**


1. Wittig, Michael, Andreas Wittig, and Ben Whaley (2018). *Amazon web services in action*.
2. Raheja, Yogesh, Giuseppe Borgese, and Nathaniel Felsen. *Elective DevOps with AWS:Imple-ment continuous delivery and integration in the AWS environment*. Packt Publishing Ltd,2018.
3. Vehent, Julien. *Securing DevOps: security in the cloud*. Simon and Schuster, 2018.
4. Sarkar, Aurobindo, and Amit Shah. *Learning AWS: Design, build, and deploy responsive applications using AWS Cloud components*. Packt Publishing Ltd, 2018.


**REFERENCE BOOKS**


1. Kavis, Michael J. *Architecting the cloud: design decisions for cloud computing service models (SaaS, PaaS, and IaaS)*. John Wiley Sons, 2014.
2. Vacca, John R., ed. *Cloud computing security: foundations and challenges*. CRC Press, 2016.
3. Furht, Borivoje, and Armando Escalante. *Handbook of cloud computing*. Vol. 3. New York: springer, 2010.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| SECOND YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | CLOUD NATIVE DEVOPS LAB |
| | COURSE CODE | 2304423L |
| | COURSE CREDITS | 1 |
| RELEASE DATE 2 | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Requires knowledge of Cloud Computing Foundations, Cloud Native Application Development

**~~COURSE OBJECTIVES :~~**

2304423L.CEO.1: To explain the historical development of DevOps, and focusing on its role in bridging the gap between development and operations teams.

2304423L.CEO.2: To guide students in understanding the architecture, fundamental concepts, and essential components of Ansible.

2304423L.CEO.3: To equip students with the skills to build, manage, and deploy Docker containers

2304423L.CEO.4: To prepare students to set up and configure a Kubernetes cluster on AWS

2304423L.CEO.5: To train students to monitor and troubleshoot CI/CD pipelines in Jenkins.

2304423L.CEO.6: To develop students' ability to write Terraform configuration files

**~~COURSE OUTCOMES :~~**

After successful completion of the course, students will be able to,

2304423L.CO.1: Deploy scalable, available containerized applications on AWS.[L3]

2304423L.CO.2: Analyze the architecture and components of Kubernetes within an AWS environment.[L4]

2304423L.CO.3: Evaluate CI/CD pipelines in Jenkins for software workflows.[L5]

2304423L.CO.4: Analyze the Terraform configuration files within an AWS environment.[L4]

**COURSE ABSTRACT:**

The Cloud Native DevOps course provides an in-depth exploration of modern development and operational practices designed for cloud-native environments. It covers key concepts, tools, and methodologies such as containerization, microservices, CI/CD pipelines, infrastructure as code, and observability. Par- ticipants will learn to build, deploy, and manage scalable, resilient, and automated applications using platforms like Kubernetes, Docker, and cloud services (e.g., AWS). Emphasizing hands-on learning, the course equips learners with skills to streamline workflows, optimize performance.andfostercollaboration between development and operations teams, ensuring robust

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Ansible Inventory and Ad-Hoc Commands.** | **4 HOURS** |
| • Install Ansible and verify the installation.<br>• Setup SSH keys and run basic Ansible commands to test the connection.<br>• Configure an inventory file and run Ad-Hoc commands.<br>• Perform operations like starting/stopping services, installing packages on managed nodes. | | |
| **PRACTICAL NO.02** | **Ansible Playbooks.** | **2 HOURS** |
| • Write a basic playbook to automate the installation of Apache HTTP server and start the service.<br>• Create tasks to manage configuration files.<br>• Create roles to manage a multi-tier application.<br>• Secure credentials with Ansible Vault. | | |
| **PRACTICAL NO.03** | **Docker Images and Dockerftle.** | **4 HOURS** |
| • Install Docker on your machine<br>• Create a custom Dockerfile to build a basic Node.js or Python application.<br>• Build and run the custom image.<br>• Launch and manage the containers using Docker Compose commands. | | |
| **PRACTICAL NO.04** | **Docker on AWS.** | **4 HOURS** |
| • Push a custom Docker image to Amazon ECR.<br>• Create an ECS cluster and define a task to run the container.<br>• Deploy a containerized application using AWS Fargate.<br>• Secure Docker containers by applying resource constraints. | | |
| **PRACTICAL NO.05** | **Core Kubernetes Concepts and Networking in AWS EKS.** | **2 HOURS** |
| • Set up an AWS EKS cluster using eksctl.<br>• Launch and configure worker nodes for the EKS cluster.<br>• Deploy a sample application (e.g., Nginx or Node.js) on the EKS cluster.<br>• Expose the application using a Kubernetes Service with an AWS ELB. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.06** | **Storage, Monitoring, and Logging in Kubernetes on AWS.** | **4 HOURS** |
| • Deploy a stateful application (e.g., MySQL) with Persistent Volumes using AWS EBS.<br>• Set up Cloud Watch monitoring and logs for an EKS cluster.<br>• Use Prometheus and Grafana to monitor the Kubernetes cluster.<br>• Configure Horizontal Pod Autoscaler (HPA) and Cluster Autoscaler for an application. | | |
| **PRACTICAL NO.07** | **Jenkins Job Conftguration and Pipeline Creation.** | **4 HOURS** |
| • Install Jenkins on a local machine or cloud instance.<br>• Explore Jenkins' user interface and configure basic settings.<br>• Create and configure a Freestyle project to pull code from GitHub and run a build.<br>• Write a simple Jenkins pipeline using the Pipeline Syntax. | | |
| **PRACTICAL NO.08** | **Advanced Jenkins Pipelines and Integration with Tools.** | **2 HOURS** |
| • Create an advanced Jenkins pipeline with stages: Build, Test, Package, and Deploy.<br>• Integrate Jenkins with Maven or npm to automate the build process.<br>• Build a Docker image using a Jenkins pipeline and push it to Docker Hub.<br>• Deploy the Dockerized application to a cloud provider (AWS EC2, Google Cloud, etc.). | | |
| **PRACTICAL NO.09** | **Building AWS Infrastructure with Terraform.** | **2 HOURS** |
| • Install Terraform and configure it to interact with AWS.<br>• Write a basic Terraform configuration file to launch an AWS EC2 instance.<br>• Storing Terraform state locally vs. remotely (e.g., in S3).<br>• State management commands: terraform show, terraform state list, terraform state rm. | | |
| **PRACTICAL NO.10** | **Advanced Terraform Features and AWS Resource Provisioning.** | **2 HOURS** |
| • Use a Terraform module to provision a VPC with subnets, route tables, and an internet gateway.<br>• Use data sources to find an AMI and launch an EC2 instance within the created VPC.<br>• Automate the creation of an Auto Scaling Group with a Load Balancer and attach instances dynamically.<br>• Set up a Terraform workspace for managing multiple environments (development, staging, produc- tion).<br>• Automate the provisioning of resources using a CI/CD pipeline (e.g., Jenkins with Terraform). | | |

**TEXT BOOKS**


1. Wittig, Michael, Andreas Wittig, and Ben Whaley (2018). *Amazon web services in action*.
2. Raheja, Yogesh, Giuseppe Borgese, and Nathaniel Felsen. *Elective DevOps with AWS: Imple-ment continuous delivery and integration in the AWS environment*. Packt Publishing Ltd, 2018.
3. Vehent, Julien. *Securing DevOps: security in the cloud*. Simon and Schuster, 2018.
4. Sarkar, Aurobindo, and Amit Shah. *Learning AWS: Design, build, and deploy responsive applications using AWS Cloud components*. Packt Publishing Ltd, 2018.


**REFERENCE BOOKS**


1. Kavis, Michael J. *Architecting the cloud: design decisions for cloud computing service models (SaaS, PaaS, and IaaS)*. John Wiley Sons, 2014.
2. Vacca, John R., ed. *Cloud computing security: foundations and challenges*. CRC Press, 2016.
3. Furht, Borivoje, and Armando Escalante. *Handbook of cloud computing*. Vol. 3. New York: springer, 2010.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | Ethical Hacking and Cyber Laws |
| | COURSE CODE | 2304424T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE :** Cryptography and System Security, Cyber Security and Forensic

**COURSE OBJECTIVES :**

2304424T.CEO.1: Equip learners with the knowledge of common hacking techniques, including penetration testing, vulnerability analysis, and exploit discovery.

2304424T.CEO.2: To gather detailed information about a target system or network, including IP addresses, domain names, and network infrastructure.

2304424T.CEO.3: Identify the weaknesses in systems and networks before malicious actors exploit them with the help of vulnerability assessment methods.

2304424T.CEO.4: Explain the privilege escalation technique and gain access to a targeted system.

2304424T.CEO.5: Identify different web server attacks and countermeasures.

2304424T.CEO.6: To understand the step-by-step methodology used in web application hacking.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304424T.CO.1: Identify the hacking concepts, techniques, and scopes [L3].

2304424T.CO.2: Experiment with the digital footprint technique to better understand the system's structure, and detect vulnerabilities. [L3].

2304424T.CO.3: Identify, quantify, and prioritize vulnerabilities in a system, network, or application in order to analyze its security weaknesses and potential risks [L4].

2304424T.CO.4: Apply different techniques to privilege escalation and gain access to a system [L3].

2304424T.CO.5: Analyze various web server attacks and their countermeasures[L4].

2304424T.CO.6: Classify different techniques to perform various web application and mobile application attacks [L4].

**COURSE ABSTRACT:**

The Ethical Hacking Course provides hands-on experience in identifying, exploiting, and mitigating cybersecurity vulnerabilities. Participants use real-world tools and techniques to conduct penetration testing, vulnerability assessments, and simulated attacks on networks, systems, and web applications. The course emphasizes ethical hacking principles, legal considerations, and developing skills to safeguard organizational assets from malicious threats. Through practical exercises, learners gain proficiency in offensive and defensive cybersecurity strategies, preparing them for roles in ethical hacking, network security, and incident response.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Security Foundations** | **06 HOURS** |

**Applications/Case Study:** Case study on Ethical Hacking Methodology

**Contents:** Overview of Ethics and hacking, Attack Modeling, Methodology of Ethical hacking, Information Assurance and Risk, Policies, Standards, and Procedures, organizing your protections, and security technology.

**Self Study:** Ethical hacking phases

**Further Readings:** Risk assessment and management.

| | | |
|---|---|---|
| **UNIT 2** | **Footprinting and Reconnaissance** | **06 HOURS** |

**Applications/Case Study:** Demonstration to gather the information of targeted system

**Contents:** Footprinting: Concept, Footprinting through search engines, Web services, Social Networking Sites, Websites, email, Social engineering, Whois, DNS. Footprinting Countermeasures Scanning Networks: Network Scanning Concepts, Scanning Tools, Port and Service Discovery, OS Discovery, Vulnerability Scanning, packet crafting and manipulation.

**Self Study:**Nmap Scanning techniques.

**Further Readings:**Banner grabbing using scanning tools.

| UNIT 3 | Vulnerability Analysis | 06 HOURS |
|---|---|---|
| **Applications/Case Study:** Demonstration NESSUS tool for Vulnerability Assessment<br>**Contents:** Vulnerability Assessment Concepts, Classification and Assessment Types, Assessment Solutions and Tools, Assessment Reports<br>**Self Study:** Explore the different methods in NESSUS/Acunetix, Burp Suite.<br>**Further Readings:** Generate the Vulnerability Assessment Report on the web application. | | |
| **UNIT 4** | **System Hacking** | **08 HOURS** |
| **Applications/Case Study:** Demonstration on Social Engineering technique using Kali Linux **System Hacking Concepts:** Searching for Exploits, Gathering passwords, password cracking, client- side vulnerabilities, Sniffing, Social Engineering, and Denial of Services.<br>**Self Study:** DDoS Attack and preventation methods.<br>**Further Readings:** Methods of authentication bypass | | |
| **UNIT 5** | **Hacking Web Servers** | **08 HOURS** |
| **Applications/Case Study:** Case study on web server attack<br>**Contents:** Web server Concepts, Web Server attacks, webserver attack methodology, web server attack tools, Countermeasures, patch management, web server security tools.<br>**Self Study:** Explore web security tools in Kali Linux.<br>**Further Readings:** Web server password hacking , Session hijacking. | | |
| **UNIT 6** | **Hacking Web Application and Wireless Network** | **08 HOURS** |
| **Applications/Case Study:** Demonstrate on SQL inject on web application<br>**Contents:** Web application concepts, threats, hacking methodology, Web Application Security, SQL Injection tools and techniques Wireless Networks: Concept, Encryption, Threats, Methodology and Tools, Wireless security: Wifi, bluetooth etc. Hacking Mobile Platforms: Mobile platform attack vectors, Hacking Android OS, Mobile device management, Mobile Security and Guidelines and tools<br>**Self Study:** Identify different mobile application attacks and tools.<br>**Further Readings:** Packing sniffing methodology. | | |

**TEXT BOOKS**

1. Ethical Hacking and Countermeasures V12, Professional Series by EC-Council.
2. Hacking: The Art of Exploitation, 2nd Edition by Jon Erickson

**REFERENCE BOOKS**

1. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, 2nd Edition by Dafydd Stuttard and Marcus Pinto.
2. Gray Hat Hacking The Ethical Hackers Handbook, 3rd Edition" by Allen Harper and Shon Harris

**E-R ESOURCES**

1. https://onlinecourses.nptel.ac.in/noc22_cs13/course

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | ETHICAL HACKING AND CYBER LAWS LAB |
| | COURSE CODE | 2304424L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Cryptography and System Security, Cyber Security Forensic

**COURSE OBJECTIVES :**

2304424L.CEO.1: Illustrate Elements of Information Security. 2304424L.CEO.2:
Identify the different tools for footprinting.
2304424L.CEO.3: Identify different types of vulnerabilities and vulnerability Assessment Tools and Techniques.
2304424L.CEO.4: Identify different web servers, web applications attacks and countermeasures.
2304424L.CEO.5: Understand mobile and wireless applications to identify potential security vulnerabilities

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304424L.CO.1: Apply different approaches to perform Footprinting through search engines, web, and network sites [L3].
2304424L.CO.2: Apply different scanning tools to identify the host, port, and services of the target system [L4].
2304424L.CO.3: Analyze the vulnerabilities in a given application using appropriate tools [L4].
2304424L.CO.4: Identify and exploit vulnerabilities in web applications that allow malicious SQL queries, to gain unauthorized access [L3].
2304424L.CO.5: Examine security vulnerabilities in mobile and wireless applications [L4]

**COURSE ABSTRACT:**

The Ethical Hacking Lab Course provides hands-on experience in identifying, exploiting, and mitigating cybersecurity vulnerabilities. Participants use real-world tools and techniques to conduct penetration testing, vulnerability assessments, and simulated attacks on networks, systems, and web applications. The course emphasizes ethical hacking principles, legal considerations, and developing skills to safeguard organizational assets from malicious threats. Through practical exercises, learners gain proficiency in offensive and defensive cybersecurity strategies, preparing them for roles in ethical hacking, network security, and incident response.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Foot printing and Reconnaissance.** | **4 HOURS** |
| Perform footprinting on the target network/system using search engines, web services, and social net- working sites. | | |
| **PRACTICAL NO.02** | **Network Scanning.** | **4 HOURS** |
| 1) Perform host, port, service, and OS discovery on the target network 2) Perform scanning on the target network beyond IDS and Firewall | | |
| **PRACTICAL NO.03** | **Vulnerability Assessment.** | **4 HOURS** |
| Perform vulnerability assessment using various vulnerability assessment tools and analyze the vulner- able reports. | | |
| **PRACTICAL NO.04** | **Web Application Attacks.** | **4 HOURS** |
| 1) Sniffing: ARP poising using arpspoofing 2) Social Engineering 3) DoS or Session Hijacking . | | |
| **PRACTICAL NO.05** | **Hacking Web Servers.** | **4 HOURS** |
| 1) Perform Privilege Escalation to Gain Higher Privileges 2) Perform Web Cache Poisoning Attack | | |
| **PRACTICAL NO.06** | **Hacking Web Application.** | **4 HOURS** |
| 1) Perform SQL Injection and SQL Map 2) Perform a brute force attack for password cracking 3) Perform Cross Site Request forgery (CSRF) attack . | | |
| **PRACTICAL NO.07** | **Hacking Wireless Networks.** | **2 HOURS** |
| 1) Crack a WEP Network using Wifiphisher 2) Crack a WEP Network using Aircrack-ng | | |
| **PRACTICAL NO.08** | **Hacking Mobile Platforms.** | **2 HOURS** |
| SMS Phishing attack (SMishing) | | |

**TEXT BOOKS**

1. Ethical Hacking and Countermeasures V11, Professional Series by EC-Council
2. Hacking: The Art of Exploitation, 2nd Edition by Jon Erickson

**REFERENCE BOOKS**

1. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, 2nd Edition by Dafydd Stuttard and Marcus Pinto.
2. Gray Hat Hacking The Ethical Hackers Handbook, 3rd Edition" by Allen Harper and Shon Harris

**E-R ESOURCES**

1. https://nptel.ac.in/courses/106105217
2. https://tryhackme.com/r/hacktivities/practice

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY | COURSE NAME | INFRASTRUCTURE MANAGEMENT |
| | COURSE CODE | |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** Software Engineering

**COURSE OBJECTIVES :**

2304476T.CEO.1: I ntroduce students to the fundamentals of IT and physical infrastructure management.
2304476T.CEO.2: Develop skills in planning, monitoring, and maintaining infrastructure for reliability and scalability.
2304476T.CEO.3: Connect theory with real-world applications in enterprise and academic

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304476T.CO.1: Explain fundamental components and scope of IT & physical infrastructure. [L2].
2304476T.CO.2: Apply planning and monitoring techniques to design secure, scalable, and resilient systems.[L3]
2304476T.CO.3: Analyze case studies and emerging trends to propose practical improvements in infrastructure management.[L4]

**COURSE ABSTRACT:**

Infrastructure Management is a multidisciplinary course designed to equip students with the knowledge and skills required to plan, deploy, operate, and optimize modern IT and physical infrastructures. The course emphasizes the integration of technology, processes, and people to ensure reliable, secure, and sustainable operations across enterprises.

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **BASICS OF INFRASTRUCTURE MANAGEMENT** | **06 HOURS** |
| **Applications/Case Study:** EcoBuild Construction Projects.<br>**Contents:** Definition and scope of infrastructure management, Types of infrastructure: IT, physical, cloud, hybrid Role of infrastructure managers in organizations, Key challenges and trends<br>**Self Study:** Monitoring and Controlling (Life cycle Phase).<br>**Further Readings:** Agile methodologies. | | |
| **UNIT 2** | **IT INFRASTRUCTURE COMPONENTS** | **06 HOURS** |
| **Applications/Case Study:** GreenVille Urban Development Project.<br>**Contents: Ha**rdware (servers, storage, networking devices), software (operating systems, middleware, virtualization), data centers (design, cooling, power, redundancy), cloud infrastructure basics (IaaS, PaaS, SaaS)<br>**Self Study:**Work Breakdown Structure (WBS).<br>**Further Readings:**Asana ((Project Management Tool). | | |
| **UNIT 3** | **INFRASTRUCTURE PLANNING AND DEPLOYMENT** | **06 HOURS** |
| **Applications/Case Study:** Skyline Residential Complex.<br>**Contents:C** apacity planning and scalability, network design and management (LAN, WAN, VPN), security considerations, disaster recovery and business continuity planning<br>**Further Readings:**e-Builder (Cost Estimation tool). | | |

| UNIT 4 | MONITORING AND MAINTENANCE | 06 HOURS |
|---|---|---|

**Applications/Case Study:** TechNova Software Development Project.

**Contents:** Tools for infrastructure monitoring (Nagios, Zabbix, Prometheus), performance tuning and optimization, preventive and corrective maintenance, incident and problem management

**Further Readings:**Trello ( web-based project management tool).

| UNIT 5 | Emerging Trends and Case Studies | 06 HOURS |
|---|---|---|

**Applications/Case Study:** GlobalTech Innovations.

**Contents: c** loud-native infrastructure and DevOps practices, Infrastructure as Code (Ansible, Terraform), green IT and sustainable infrastructure, industry and academic case studies

**Self Study:** CMMI (Maturity Model). .

**Further Readings:** Maturity Models in Agile Environments.

**TEXT BOOKS**


1. John M. Nicholas and Herman Steyn *Infrastructure Management for Business, Engineering, and Tech- nology*. 7th Edition 3, ELSEVIER ISBN: 978-0-7506-8399-9.
2. George Ellis *Infrastructure Management in Product Development*. 7th Copyright c 2016 Elsevier Inc,


**REFERENCE BOOKS**


1. Russ J. Martinelli, Dragan Z. Milosevic. *Infrastructure Management Toolbox*. 13th Wiley Copyright 2018, ISBN 978-1-118-97312-7.
2. Kalpesh Ashar. *Infrastructure Management Essentials You Always Wanted To Know*. vibrant publish- ers.
3. Christine Petersen. *The Practical guide to Infrastructure Management*. Edition 1 ISBN 978-87-403- 0524-1.
4. John M. Preston. *Beginning Infrastructure Management* .
5. Russell W. Darnall, John M. Preston. *Project Management from Simple to Complex*. The Open University of Hong Kong


**E-R ESOURCES**

1. https://onlinecourses.nptel.ac.in/noc24 mg01/preview.
2. https://www.coursera.org/specializations/project-management

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Major Project - III |
| | **COURSE CODE** | 2304491L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304491.CEO.1: To understand how to carry out performance evaluation and comparative analysis in appropriate form.

2304491.CEO.2: To know about standard industry practices.

2304491.CEO.3: To become familiar with the steps involved in identifying and selecting a good platform to present the work done.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304491.CO.1: Make use of standard industry practices [L3].

2304491.CO.2: Interpret the findings and compare them with the results in the literature [L5].

2304491.CO.3: Identify weaknesses and limitations in the findings and propose improvements [L3].

2304491.CO.4: Function as a team and communicate the work done by adhering to the norms of professional ethics [L4].

**COURSE ABSTRACT:**

The project is most important part of undergraduate curriculum and enables students to develop an alytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The ob- jective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effective- ness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Major Project - I, Major Project - II and Major Project - III. After successful completion of Major Project - II (Sem VI), next step is Major Project - III (Sem VII). The goal of this phase of the project is to draw Inferences and Detail Analysis/Final Testing/Re-development/etc. Showcasing the work - Technical documentation in Con-

**GUIDELINES**

1. Project group students of Sem VI would be continued in this semester VII.
2. The group members may be from different programs to support the interdisciplinary functioning.
3. Projects should preferably have a national/international, industry/academic/research collabora- tion.
4. Students should do extended implementation of their project in consultation with their advisor.
5. For extended implementation, objectives of Sem V and Sem VI should have been already achieved.
6. Every project should follow at least one standard industry practice while implementing. For example, below are some of the standard industry practices followed by Electrical engineers:
   (a) If writing a Matlab code, follow **MathWorks Advisory Board (MAB)** Guidelines
   **(b)** For embedded c coding, **Motor Industry Software Reliability Association (MISRA)** standards can be used
   (c) If antenna is manufactured, then get **EMI/EMC** testing certificate from National Accreditation Board for Testing and Calibration Laboratories.
7. Performance evaluation and Comparative analysis of results should be carried out and presented in appropriate form.
8. Carry out detail analysis to improve performance w.r.t Final Testing/Re-development/etc.
9. Showcase the work in Conferences/Journal/Patent/Product/Working model.

**Note:** *For guideline 6, every school should identify standard industry practices and try to incorporate in the projects.*

**ASSESSMENT and EVALUATION**

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Project Review I (Internal): (10 Marks)
2. Activity (Standard industry practices): (5 Marks)
3. Project Review II (External): (10 Marks)
4. Project Report: (5 Marks)
5. Every project group should publish paper in National conference / International conference / Participate in technical project competition (with achievement) / File a patent/etc.: (5 Marks)
6. Project: Final Presentation and Demonstration (External) (40 Marks)

**Note:**

- Report should be prepared in LaTeX.
- External examiner for Review 2 and Final Demo should be allocated same group.
- Report will be jointly evaluated by External examiner and Internal examiner.

**REFERENCES**


1. Eng-Choon Leong et al (2015). Guide To Research Projects For Engineering Students. CRC press, Apple Academic Press Inc. ISBN: 9781482238778, 9781482238778.
2. Michelle Reid (2018). Report Writing (Pocket Study Skills). Second Edition, Macmillan Educa- tion.
3. Leslie Lamport (2011). A Document Preparation System LaTeX: User's Guide and Reference Manual. Pearson.


**E-R ESOURCES**

1. IEEE Author Center
2. Intellectual Property India - Indian Patent Office
3. FlowingData
4. Design and Analysis of Experiments

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Research Methodology |
| | **COURSE CODE** | 2304492T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**~~COURSE OBJECTIVES~~ :**

2304492.CEO.1: To enable defining and formulating research approaches towards obtaining solutions to practical problems.

2304492.CEO.2: To facilitate development of scientific oral and written communication skills.

2304492.CEO.3: To comprehend the concepts behind adhering to scientific ethics and values.

**~~COURSE OUTCOMES~~ :**

After successful completion of the course, students will be able to,

2304492.CO.1: Apply the key concepts of research methodology to provide real world solutions [L3].

2304492.CO.2: Analyze the research problems and results to evaluate the methodologies, identify limitations, and draw conclusions [L4].

2304492.CO.3: Apply scientific writing skills for preparing dissertation, research articles and research proposals [L3].

2304492.CO.4: Evaluate the ethical implications of the use of artificial intelligence tools in research, focusing on issues such as data privacy, algorithmic bias, transparency, accountability, and responsible use of AI to ensure fairness and integrity in research results [L5].

**COURSE ABSTRACT:**

Research methodology is a structured and scientific approach used to collect, analyze, and interpret quantitative or qualitative data to answer research questions or test hypotheses. A research methodology is like a plan for carrying out research and helps keep researchers on track by limiting the scope of the research. Several aspects must be considered before selecting an appropriate research methodology, such as research limitations and ethical concerns that may affect your research

A research methodology describes the techniques and procedures used to identify and analyze information regarding a specific research topic. It is a process by which researchers design their study so that they can achieve their objectives using the selected research instruments. It includes all the important aspects of research, including research design, data collection methods, data analysis methods, and the overall framework within which the research is conducted. While these points can help you understand what is

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **Introduction to Research methodology** | **6 HOURS** |
| **Contents:** Meaning of research, Types of research, Research process, Problem definition, Objectives of research, Research questions, Research design, Approaches to research, Quantitative vs. qualitative approach, Understanding theory, Building and validating theoretical models, Exploratory vs. confirmatory research, Experimental vs theoretical Research, Importance of reasoning in research. | | |
| **UNIT 2** | **Problem formulation** | **8 HOURS** |
| **Contents:** Problem formulation, Conducting literature review, Referencing, Information sources, Information retrieval, Role of libraries in information retrieval, Tools for identifying literatures, Indexing and abstracting services, Citation indexes. | | |
| **UNIT 3** | **Result Analysis** | **6 HOURS** |
| **Contents:** Experimental research, Cause effect relationship, Development of hypothesis, Measurement systems analysis, Error propagation, Validity of experiments , Statistical design of experiments , Field experiments, Data/Variable types & classification, Data collection, Numerical and graphical data analysis, Sampling, Observation, Surveys, Inferential statistics and interpretation of result. | | |
| **UNIT 4** | **Scientiftc Writing** | **4 HOURS** |
| **Contents:** Preparation of dissertation, research papers and proposals, Tables and illustrations, Guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript, References, citation, and listing system of documents. Ethics of Research, Scientific Misconduct, Forms of Scientific Misconduct. Plagiarism, Unscientific practices in thesis work, IPR: To give an idea about IPR, registration, patents,copyrights, and its enforcement. | | |
| **UNIT 5** | **Artiftcial Intelligence Tools & Ethics in Research** | **4 HOURS** |

**Contents:** Role of AI in modern research practices, AI Tools for Data Collection and Analysis, Ethical Considerations in AI for Research, AI, Research Integrity, and Bias, Responsible Use of AI in Research, Future Trends in AI and Research Ethics, NITI Aayog National Strategy for Artificial Intelligence.

**TEXT BOOKS**


1. C. R. Kothari (2023). Research Methodology. New Age International Publishers, Fifth Edition, ISBN: 978-9389802559.
2. Ranjit Kumar (2024). Research Methodology: A Step by Step Guide for Beginners. SAGE Publications, Fourth Edition, ISBN: 978-9351501336.


**REFERENCE BOOKS**


1. Shanti Bhushan Mishra, Shashi Alok (2017). Handbook of Research Methodology. Educreation, First Edition, ISBN: 978-1-5457-0340-3.
2. Chandra Vinod, Hareendran Anand (2017). Research Methodology. Pearson Education, First Edition, ISBN:978-9352863518.


**E-R ESOURCES**

1. National Strategy for Artificial Intelligence
2. AI Standards & Policies

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | Summer Internship (Technical) |
| | **COURSE CODE** | 2304496L |
| | **COURSE CREDITS** | 4 |
| **RELEASE DATE :** | **REVISION NO** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | NIL | 150 | 150 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2304496L.CEO.1: To enhance technical skills and self-directed learning.

2304496L.CEO.2: To develop adaptability and resilience in a multicultural or professional environment. product/system/software.

2304496L.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2304496L.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2304496L.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304496L.CO.1: Analyse the organizational structure and workflow of a professional setup to identify opportunities for optimization and innovation [L4].

2304496L.CO.2: Design innovative products, systems, or software by integrating interdisciplinary knowledge and addressing real-world challenges [L5].

2304496L.CO.3: Collaborate effectively within multidisciplinary teams to achieve project objectives, demonstrating strategic decision-making and problem-solving skills [L4].

2304496L.CO.4: Evaluate industry-relevant practices through hands-on experience, enhancing profes- sional competence and adaptability [L4].

2304496L.CO.5: Formulate comprehensive and innovative engineering problem statements by synthe- sizing technical knowledge and industry insights [L4].

2304496L.CO.6: Analyze project feasibility using cost estimation, budgeting, and financial metrics

**INTRODUCTION**

The Student Internship Program (SIP) aims to empower final-year entrants B.Tech. students by providing them with valuable opportunities to engage with industry and academic centers of excellence. Through SIP, students gain comprehensive practical experience that bridges the gap between classroom learning and real-world application.

The program is designed to cultivate professionalism, enhance networking capabilities, and strengthen academic and professional skills, ensuring students are well-prepared for the demands of today's competitive global market. By participating in internships, students can apply their academic knowledge in professional settings, fostering a deeper understanding of their field and equipping them with the

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the final year of the B.Tech. program, to be undertaken during the summer break after Semester VI. This program aims to provide opportunities for skill enhancement through industrial internship or research internship exposure. The internship focuses on helping students identify and engage with relevant MNC, medium scale enterprise, or small-scale industries, or research organization to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

- **Duration:** : 4 to 8 weeks (minimum of 160 hours).
- **Timeframe:** Conducted during June-July of each academic year.
- **Nature of Internship:**

1. Industrial internship with MNC or medium-scale industries.
2. Research internship in the CSIR lab or DRDO / IIT / IISc / NCL / NEERI etc

- **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.
- **Mentorship:** Each third-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development. **Student Development Focus :**

Before selecting an internship option, second-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance inidentifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

**1. Continuous Assessment (CA): Biweekly Progress Reports and interaction with faculty mentor (40%):**

Students must submit at least two progress reports during the internship/training period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them

**2. Detailed Project Report with Learning Outcomes (30%)**

Upon completion of the internship, students are required to submit a comprehensive minimum of 30 to 40 pages' internship/project report. The report must include:

1. Overview of the Industry/Research Institute
2. Skills and knowledge acquired (technical).
3. Specific challenges addressed
4. Personal and professional growth reflections
5. Clearly stated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certiftcate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | CYBER SECURITY |
| | **COURSE CODE** | 2304412T |
| | **COURSE CREDITS** | 4 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 4 | NIL | 60 | NIL | 90 | NIL | NIL | 150 |

**PREREQUISITE :** COMPUTER NETWORK

**~~COURSE OBJECTIVES~~ :**

2304412T.CEO.1: Introduce foundational cybersecurity concepts including threats, vulnerabilities, encryption, and ethical hacking methodologies.

2304412T.CEO.2: Equip learners with practical knowledge of securing network infrastructure and endpoints

2304412T.CEO.3: Enable students to apply AI and ML techniques for threat detection and defense

2304412T.CEO.4: Integrate computer vision approaches for malware and anomaly detection.

2304412T.CEO.5: Understand and implement IoT security and communication protocols.

2304412T.CEO.6: Explore and apply cloud security best practices in real-world contexts

**~~COURSE OUTCOMES~~ :**

After successful completion of the course, students will be able to,

2304412T.CO.1: Explain core cyber security principles and apply incident response strategies. [L3].

2304412T.CO.2: Demonstrate hands-on ability to secure networks and systems [L3].

2304412T.CO.3: Apply AI/ML models for threat detection and defense against adversarial attacks [L3].

2304412T.CO.4: Implement computer vision for malware detection and biometric access control [L3].

2304412T.CO.5: Design and secure IoT infrastructures addressing vulnerabilities and privacy [L3].

2304412T.CO.6: Apply cloud security tools and practices to prevent misconfigurations and data leaks [L3].

**COURSE ABSTRACT:**

This course offers a deep dive into modern cybersecurity, covering foundational principles, network defenses, AI-driven threat detection, computer vision security, IoT protection, and cloud security. Through real-world case studies and hands-on labs, students learn to analyze attacks, secure systems, and apply cutting-edge tools and techniques. Emphasis is placed on practical skills in threat modeling, adversarial AI, steganography, and secure cloud configurations. By the end of the course, learners will be equipped to build and manage resilient, intelligent, and secure digital environments.

**THEORY COURSE CONTENTS**

| UNIT 1 | FOUNDATIONS OF CYBERSECURITY | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Dissection of the SolarWinds supply chain attack — mapping attack vectors and response strategies.

**Contents:Introduction to Cybersecurity:** Basic concepts, threats, vulnerabilities, and security principles. **Data Security:** Data encryption, access control and data loss prevention.**Application Security:** Secure development practices, input validation.**Ethical Hacking:** Understanding how attackers think and testing security measures. **Incident Response:** Procedures for handling security breaches. **Lab:** Network analysis using Wireshark and threat modeling with STRIDE

**Self Study:** History of major cyber attacks (e.g., Stuxnet, Equifax breach) ,CIA Triad

**Further Readings:** Advanced Persistent Threats (APT), Security Information and Event Management (SIEM)

| UNIT 2 | NETWORK AND SYSTEM SECURITY | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Analysis of the Dyn DNS DDoS attack via IoT devices — securing endpoints and networks.

**Contents:** Firewalls, IDS/IPS, Zero Trust Architecture. Common attacks: DDoS, Man-in-the-Middle (MITM), Endpoint security and patch management

**Lab:** Simulate DDoS using LOIC, firewall configuration

**Self Study:**Packet inspection and protocol layers (OSI model), Network segmentation and VLANs

**Further Readings:**Intrusion Detection Using Deep Learning,Software-Defined Perimeter (SDP).

| UNIT 3 | INTELLIGENT SECURITY SYSTEMS: AI TECHNIQUES | 10 HOURS |
|---|---|---|

**Applications/Case Study:**Attacking an image classifier with adversarial inputs — evasion and mitigation techniques.

**Contents:AI and ML Fundamentals:** Understanding machine learning algorithms, neural net- works, and other AI techniques. **AI-Driven Threat Detection:** Using AI to identify and prevent malicious activity. **Anomaly Detection**: Detecting unusual patterns in network traffic or system behaviour.**Adversarial AI:** Understanding how AI models can be manipulated and how to defend against adversarial attacks.**AI-Powered Security Solutions:** Exploring various AI-based security tools and technologies. **Lab:** Perform an FGSM adversarial attack on a CNN model using PyTorch or TensorFlow

**Self Study:** Basics of supervised vs unsupervised learning, Confusion matrix and ROC curves for model evaluation, Adversarial example generation techniques

**Further Readings:**Explainable AI (XAI) for Cybersecurity, Transfer Learning in Threat Detection.

| UNIT 4 | SECURING SYSTEMS WITH COMPUTER VISION | 10 HOURS |
|---|---|---|

**Applications/Case Study:**Multi-Layered Threat Detection and Access Control Using Computer Vision Techniques.

**Contents: Computer Vision Fundamentals:**Understanding image processing, object recognition, and machine vision techniques. **Malware Detection in Images:** Using computer vision to identify malware embedded in images, especially in phishing emails. **Image-Based Anomaly Detection:** Using computer vision to detect unusual patterns in visual data, like network traffic or video footage. **Facial Recognition for Access Control:** Implementing facial recognition systems for secure access to physical and digital environments.

**Lab:** Malware Detection in Images (Steganography Analysis)

**Self Study:** Image classification vs object detection, Common CV architectures (e.g., CNNs, YOLO, ResNet), Introduction to steganography and digital watermarking

**Further Readings:**Deepfake Detection Techniques, Vision-Based Behavioral Biometrics, 3D Facial Recognition and Spoofing Countermeasures

| UNIT 5 | BUILDING RESILIENT IOT SYSTEMS | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Exploiting the Mirai botnet — understanding how unsecured IoT devices are hijacked.

**Contents: IoT Security Fundamentals:** Understanding the vulnerabilities of IoT devices and net- works. **Securing IoT Devices:** Implementing security measures for IoT devices, including authen- tication, encryption, and intrusion detection.**IoT Network Security:** Securing the communication channels and protocols used by IoT devices. **Data Privacy in IoT:** Addressing privacy concerns related to the collection, storage, and use of data from IoT devices. **IoT Device Security Manage- ment:** Managing the security of a large number of IoT devices.

**Lab:** Firmware extraction and basic analysis using Binwalk; scan IoT devices via Shodan

**Self Study:** IoT protocols: MQTT, CoAP. Common IoT OS platforms: RIOT, Contiki.Device hard- ening and secure boot

**Further Readings:** Secure Boot and Trusted Execution Environment (TEE),Blockchain for IoT Se- curity and Authentication, AI-Powered Intrusion Detection for IoT Networks.

| UNIT 6 | CLOUD AND QUANTUM SECURITY | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Case of Uber's S3 bucket data leak — how misconfigurations led to massive data exposure.

**Contents:** Introduction to Cloud Computing, Types of Cloud Computing : Public, Private and Hy- brid, Cloud service models (IaaS, PaaS, SaaS), Identity Access Management (IAM), encryption, audit logs, **Cloud security tools:** AWS Inspector, GCP Security Command Center.**Quantum Comput- ing and Security:**Overview of Quantum Computing fundamentals,Threats to classical encryption by quantum algorithms (e.g., Shor's algorithm),Post-quantum cryptography and future-safe cryptographic standards.

**Lab:** Implement RBAC and encryption in AWS free tier **Self Study:**Cloud misconfiguration risks and prevention, IAM policies and RBAC vs ABAC. Cloud-native threat modeling

**Further Readings:** Cloud Security Posture Management (CSPM).

**TEXT BOOKS**


1. William Stallings, Lawrie Brown (2018). *Computer Security: Principles and Practice.* 4th Edition, Pearson. ISBN: 9780134794105.
2. Mark Stamp (2020). Information Security: *Principles and Practice*. 3rd Edition, Wiley. ISBN: 9781119570485.
3. Al-Sakib Khan Pathan (2016). *Security of Internet of Things: Challenges and Solutions*. CRC Press. ISBN: 9781138031784.
4. Tim Mather, Subra Kumaraswamy, Shahed Latif (2009). *Cloud Security and Privacy*. O'Reilly Media. ISBN: 9780596802769.


**REFERENCE BOOKS**


1. Clarence Chio, David Freeman (2018). *Machine Learning and Security: Protecting Systems with Data and Algorithms*. O'Reilly Media. ISBN: 9781491979907.
2.
3. William Stallings (2013). *Network Security Essentials: Applications and Standards*. 4th Edition, Pearson. ISBN: 9780133370430.
4. Mohamed Elgendy (2020). *Deep Learning for Vision Systems. Manning Publications.* ISBN: 9781617296192.
5. Bruce Schneier (2015). *Applied Cryptography: Protocols, Algorithms, and Source Code in C*. 20th Anniversary Edition, Wiley. ISBN: 9781119096725.


**E-R ESOURCES**

1. OWASP (Open Web Application Security Project) – https://owasp.org
2. Shodan (IoT Device Search Engine) – https://www.shodan.io
3. Wireshark Official Documentation – https://www.wireshark.org/docs/
4. AWS Security Documentation – https://docs.aws.amazon.com/security

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | Semester Long Internship Program (SLIP) |
| | **COURSE CODE** | 2304497L |
| | **COURSE CREDITS** | 8 |
| **RELEASE DATE :** | **REVISION NO** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | 150 | 150 | 300 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2304497L.CEO.1: To get acquainted with the organization structure

2304497L.CEO.2: To gain learning and living experience

2304497L.CEO.3: To develop appropriate workplace attitudes

2304497L.CEO.4: To get Hands-on experience in the related field to relate and reinforce what has been taught at the university

2304497L.CEO.5: To formulate the problem statement

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304497L.CO.1: Analyze real-world engineering problems and propose effective solutions using domain-specific knowledge [L4].

2304497L.CO.2: Evaluate suitable problem-solving methodologies and modern tools to address practical engineering challenges [L5].

2304497L.CO.3: Demonstrate the ability to work effectively in cross-cultural and multidisciplinary teams within a professional environment [L4].

2304497L.CO.4: Develop and demonstrate teamwork, leadership, and communication skills required for collaborative and individual tasks [L4].

2304497L.CO.5: Apply ethical principles and commit to professional responsibilities and norms in engineering practice [L3].

2304497L.CO.6: Demonstrate awareness of the need for, and engage in, independent and lifelong learn-

**INTRODUCTION**

The Final-Year Semester-long internship program is structured to provide B.Tech. students with extended, in-depth exposure to real-world industrial environments and academic centers of excellence. Spanning 4 to 6 months, this internship serves as a vital bridge between academic coursework and professional practice, enabling students to apply theoretical knowledge to complex, practical challenges.

Through sustained engagement in industry settings, students develop critical technical compe- tencies, professional ethics, and workplace readiness. The program nurtures a sense of responsibility, fosters independent thinking, and sharpens problem-solving and project management skills. It also enhances students' ability to collaborate in multidisciplinary and multicultural teams, preparing them for dynamic, global work environments.

By immersing themselves in live projects, students gain hands-on experience, expand their pro- fessional network, and build the confidence and expertise necessary to transition seamlessly into their careers or

**SCOPE AND STRUCTURE OF SIP:**

**Scope:**

The Student Internship Program in Technical Skills is designed for students the final year of the B.Tech. program, to be undertaken after Semester VII. This program aims to provide opportunities for skill enhancement through industrial internship or research internship exposure. The internship focuses on helping students identify and engage with relevant MNC, medium scale enterprise, or small-scale industries, or research organization to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

- **Duration:** 16 to 24 weeks.
- **Timeframe:** Conducted during Jan-June of each academic year.
- **Nature of Internship:**

1. Industrial internship with MNC or medium-scale industries.
2. Research internship in the CSIR lab or DRDO / IIT / IISc / NCL / NEERI etc

- **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.
- **Mentorship:** Each final-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

**Internship Format and Personal Development Focus:**

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development. **Student Development Focus :**

Before selecting an internship option, final-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance inidentifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

**1. Continuous Assessment (CA): (Biweekly Progress Reports, Faculty Mentor Interaction Mid-Term Review) (50%)**

Students must submit biweekly progress reports during the internship period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them
- Regular interaction with the assigned faculty mentor is expected for guidance and monitoring. **A mid-term review will be conducted between the 8th and 12th week of the internship**. This review will evaluate the student's progress, alignment with learning objectives, and address any critical feedback for improvement. It will be considered as part of the CA component.

**2. Detailed Project Report with Learning Outcomes (20%)**

Upon completion of the internship, students are required to submit a comprehensive internship/project report (minimum 40 to 60 pages) which should include:

1. Overview of the Industry/Research Institute
2. Skills and knowledge acquired (technical).
3. Specific challenges addressed,
4. Reflections on personal and professional growth
5. Clearly articulated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certiftcate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| INFORMATION TECHNOLOGY | W.E.F | |
| FINAL YEAR BACHELOR TECHNOLOGY | COURSE NAME | Capstone Portfolio |
| | COURSE CODE | 2304493L |
| | COURSE CREDITS | 08 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 16 | NIL | NIL | NIL | 150 | 150 | 300 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304493.CEO.1: Identify solutions at different scales, ensuring sustainability within diverse engineering contexts.

2304493.CEO.2: Develop a capstone project or research internship problem adhering to standard engineering practices with precision and accuracy.

2304493.CEO.3: Organize artifacts and results through teamwork and effective communication under project or research internship constraints.

2304493.CEO.4: Synthesize findings into a reflective report that communicates results with professional ethics.

2304493.CEO.5: Create a professional portfolio showcasing achievements and growth aligned with engineering standards.

2304493.CEO.6: Justify progressive growth in a portfolio, highlighting contributions to sustainability

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304493.CO.1: To Analyze capstone research work and find sustainable solutions in diverse engineering contexts. [L4]

2304493.CO.2: To Design a capstone research work using methodologies aligned with engineering standards. [L4]

2304493.CO.3: To Compile artifacts and outcomes collaboratively within project or research internship constraints. [L3]

2304493.CO.4: To Evaluate findings and prepare a reflective report adhering to ethical standards. [L5]

2304493.CO.5: To Create a digital personal portfolio in engineering practices. [L4]

2304493.CO.6: To present portfolio and graduation book reflecting contributions to sustainability and teamwork. [L4]

**COURSE ABSTRACT:**

The capstone project is an individual, self-identified endeavor focusing on technical or non-technical challenges. It emphasizes risk-taking, high productivity, strong design research, and the creation of advanced solutions through innovative methodologies. Students are empowered to choose their projects, formulate solutions, negotiate deliverables, and work independently, culminating in a digital presentation. The capstone experience fosters critical thinking, problem-solving, and adaptability, aligning with professional engineering practices and research standards. A research internship complements this by exposing students to real-world applications of their skills, strengthening their ability to address complex challenges, and enhancing their professional preparedness. Together, the capstone project and internship provide a comprehensive platform for students to demonstrate their technical acumen and research capabilities. The digital portfolio and graduation book integrate these experiences into a co- hesive collection of work that reflects the evolution of skills and ideas. Combining written and visual content, it showcases critical thinking, design processes, and final artifacts. Students craft a professional voice through reflective articles, personal design philosophies, and enhanced online profiles, such as on LinkedIn. This structured portfolio serves as a powerful tool to articulate achievements and establish a professional identity.

Capstone portfolio is divided into two section a) Capstone Research work b) Digital Portfolio

**CAPSTONE RESEARCH WORK :**

Individual student can choose the topic from one of the below capstones to carry out the work during the entire semester

1. Technical Capstone
    - Industry identified problem
    - Institute identified problem
    - Urban city identified problems
    - Rural Development
    - Environmental related problems
    - Student Conceived problems
    - Satisfactory solution to Open ended problems
    - Innovative Design stemming from Student/Faculty
    - Product Development
    - App/ Software Development
    - Multidisciplinary approach to existing problem
    - Modeling/Optimization/Analysis study
2. Writing Intensive Capstone
    - Design
    - Literature Survey
    - Commercial Survey
    - Social media Survey
    - Idea/ Design Philosophy
    - Research Methodology
    - Consultancy Project work
    - Collaborative Project work
    - Laboratory/Digital classroom
    - Manage/lead any Event/activity
3. TechFrontier Capstone
    - State of art
    - Challenges and Prospect of Technology (Engineering) Education in Primary and Secondary Schools
    - Market Statistics

**DIGITAL PORTFOLIO :**

Individual student should create there own digital portfolio by using the standard professional platforms/blogs based on the record during their entire Under Graduate program. Digital portfolio should be professional, amalgamation of technical, written, graphical/Visual content and Verbal culmination of the skills and knowledge that students have developed over their under graduate program.

1. Process Portfolio
2. Show case Portfolio

**GRADUATION BOOK :**

A graduation book is a comprehensive document showcasing students' achievements, projects, and reflections during their academic journey. It serves as a portfolio and a keepsake, reflecting their growth and accomplishments.

It should basically covered following content or c vtext

1. Personal Portfolio: Focused on an individual student's projects, awards, and career goals.
2. Class/Batch Book: Highlights collective achievements, group projects, and memorable moments of a graduating class.
3. Thematic Graduation Book: Centers on a specific theme, such as innovation, sustainability, or community impact, showcasing relevant work.

**GUIDELINES :**

1. Capstone Research Project: Each student is required to individually work on their capstone project throughout the semester, ensuring sustained focus and progress.
2. Title Approval: Students must propose a title for their capstone project, subject to approval by the Supervisor and School Dean.
3. Scope of Work: The approved topic must be pursued with extensive research, accurate data, the necessary evidence, and measurable results.
4. Digital Portfolio: Students must independently create a digital portfolio to showcase their capstone work and overall growth.
5. Graduation book: Each student must authored a detailed graduation book documenting the capstone project, following plagiarism guidelines.
6. Alignment with Capstone Work: The research internship should complement the capstone project, reinforcing technical expertise, research methods, and professional skills.
7. Supervisor and Department Review: Capstone work and digital portfolios must be evaluated by the Supervisor and another faculty member from the department to ensure adherence to guidelines and quality standards.
8. Exemplary Performance Review: Exceptional capstone work may qualify for a secondary review, termed as "Capstone Work Review 2," to evaluate the student's competency. Supervisors may request a concise report if the work is deemed remarkable. Examples of exemplary achievements include:
    - Published articles in Scopus-indexed journals.
    - Approved research proposals.
    - Wins in design competitions, technical fests, or workshops.
    - Wins in state, national, or international events (technical/non-technical).
    - Valid scores in competitive exams (e.g., GATE, CAT, GRE, TOEFL, IELTS).
9. Capstone and Portfolio Assessment: Both the capstone project and digital portfolio will undergo a formal review by the supervisor and department faculty.
10. Jury Examination: The final examination will be conducted in the presence of a jury panel to evaluate the student's overall performance and competency.
11. Initiative and Ownership: Students are expected to take ownership of their work, from choosing the title to completing the capstone project and research internship independently.
12. Quality and Ethics: Work submitted must meet academic standards, demonstrating quality, originality, and ethical research practices.

**ASSESSMENT and EVALUATION :**

The Jury will be appointed to monitor the progress and continuous evaluation of each project. One of the members will be the Capstone Research work internship supervisor. The evaluation shall be performed jointly by the supervisor and the jury members.

1. Continuous assessment (150 marks)
    - Capstone Research work Review 1 (75 Marks)
    - Capstone Research work Review 2 (75 Marks)
2. Final Presentation and Demonstration (150 Marks)
    - Digital Portfolio and Graduation Book (75 Marks)
    - Capstone Research work Final demonstration (75 Marks)

**REFERENCES**


1. https://design.berkeley.edu/ Berkeley M.Des. University of California, U.S. .
   ://design.gatech.edu/ Georgia Institute of Technology, College of Design Atlanta, U.S.
2. https://www.apus.edu/ American Public University
3. https://msu.edu/ Michigan State University's US
4. https://www.cranfield.ac.uk Cranfield University, Shrivenham Swindon UK
5. https://my.bulbapp.com/personalized-learning/assessment-infographic-blog/
6. https://edtechjeffco.weebly.com
7. https://www.invisionapp.com/inside-design/10-portfolio-websites-to-show-off-your-design-work/


**E-R ESOURCES**

1. https://www.canva.com/learn/design-digital-portfolio
2. https://www.adobe.com/in/express/create/online-portfolio
3. https://www.masterclass.com/articles/how-to-make-a-digital-portfolio .
4. https://issuu.com/solutions/design/portfolio

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **INFORMATION TECHNOLOGY** | **W.E.F** | |
| **FINAL YEAR BACHELOR OF TECHNOLOGY INFORMATION TECHNOLOGY** | **COURSE NAME** | Industry Practicum |
| | **COURSE CODE** | 2304499L |
| | **COURSE CREDITS** | 8 |
| **RELEASE DATE :** | **REVISION NO** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | 150 | 150 | 300 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2304499L.CEO.1: To get acquainted with the organization structure

2304499L.CEO.2: To gain learning and living experience

2304499L.CEO.3: To develop appropriate workplace attitudes

2304499L.CEO.4: To get Hands-on experience in the related field to relate and reinforce what has been taught at the university

2304499L.CEO.5: To formulate the problem statement

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304499L.CO.1: Analyze real-world engineering problems and propose effective solutions using domain-specific knowledge [L4].

2304499L.CO.2: Evaluate suitable problem-solving methodologies and modern tools to address practical engineering challenges [L5].

2304499L.CO.3: Demonstrate the ability to work effectively in cross-cultural and multidisciplinary teams within a professional environment [L4].

2304499L.CO.4: Develop and demonstrate teamwork, leadership, and communication skills required for collaborative and individual tasks [L4].

2304499L.CO.5: Apply ethical principles and commit to professional responsibilities and norms in engineering practice [L3].

2304499L.CO.6: Demonstrate awareness of the need for, and engage in, independent and lifelong learn-

**INTRODUCTION**

The Final-Year Semester-long internship program is structured to provide B.Tech. students with extended, in-depth exposure to real-world industrial environments and academic centers of excellence. Spanning 4 to 6 months, this internship serves as a vital bridge between academic coursework and professional practice, enabling students to apply theoretical knowledge to complex, practical challenges.

Through sustained engagement in industry settings, students develop critical technical compe- tencies, professional ethics, and workplace readiness. The program nurtures a sense of responsibility, fosters independent thinking, and sharpens problem-solving and project management skills. It also enhances students' ability to collaborate in multidisciplinary and multicultural teams, preparing them for dynamic, global work environments.

By immersing themselves in live projects, students gain hands-on experience, expand their pro- fessional network, and build the confidence and expertise necessary to transition seamlessly into their careers or

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the final year of the B.Tech. program, to be undertaken after Semester VI. This program aims to provide opportunities for skill enhancement through industrial internship or research internship exposure. The internship focuses on helping students identify and engage with relevant MNC, medium scale enterprise, or small-scale industries, or research organization to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

- **Duration:** 16 to 24 weeks.
- **Timeframe:** Conducted during August-December of each academic year.
- **Nature of Internship:**

1. Industrial internship with MNC or medium-scale industries.
2. Research internship in the CSIR lab or DRDO / IIT / IISc / NCL / NEERI etc

- **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.
- **Mentorship:** Each final-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development. **Student Development Focus :**

Before selecting an internship option, final-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance inidentifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

**1. Continuous Assessment (CA): (Biweekly Progress Reports, Faculty Mentor Interaction Mid-Term Review) (50%)**

Students must submit biweekly progress reports during the internship period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them
- Regular interaction with the assigned faculty mentor is expected for guidance and monitoring. **A mid-term review will be conducted between the 8th and 12th week of the internship**. This review will evaluate the student's progress, alignment with learning objectives, and address any critical feedback for improvement. It will be considered as part of the CA component.

**2. Detailed Project Report with Learning Outcomes (20%)**

Upon completion of the internship, students are required to submit a comprehensive internship/project report (minimum 40 to 60 pages) which should include:

1. Overview of the Industry/Research Institute
2. Skills and knowledge acquired (technical).
3. Specific challenges addressed,
4. Reflections on personal and professional growth
5. Clearly articulated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certiftcate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

# Outline of Question paper

The question paper format with common instructions shall be provided to the paper setter.

around 40 percent of each paper should be structured viz questions could be set from book work, or be of similar type and difficulty as questions used in tutorials, or consist of a number of part-questions requiring brief answers

50 per cent should be testing the ability of students to apply what is taught in the class to various real-life situations (maybe case study type of questions)

10 percent of the questions should comprise of abstract questions i.e. questions related to the subject but from topics which may or may not be included in the curriculum. It should test the general reading done by the students over and above the published course content (self-learning)

Straightforward' questions or parts of questions: these are aimed at testing principles and students' basic knowledge and understanding. The average student who has worked well should have no difficulty in obtaining 40% of the total marks for the paper from the straightforward parts. These should address the first three levels of the Blooms Taxonomy - namely remembering, understanding and applying.

More difficult' questions or parts of questions: These will require extra thought and / or understanding than 'straightforward' questions, or more specialized knowledge. These will be based on the Higher order thinking skills defined by Blooms Taxonomy viz questions based on analyzing, evaluating and creating

**Setting Questions:**

a) These guidelines relate to a 2-hour prescribed marks examination paper in which all questions must be answered. The questions do not need to carry the same marks.
b) It is assumed that 30 minutes will be available, on average, per question, leaving 30 minutes for reading the examination paper and for final checking etc.
c) Quantitative questions: A suggested guide for length of quantitative questions is that it should take the examiner (who knows what the answer should be) 15 minutes to write down his specimen answer in a form which would be acceptable for the award of maximum marks. This will ensure that the examinee has 50% thinking time to go with 50% writing and calculating time
d) Descriptive questions: For purely descriptive questions the examiner should base the question on about 20 minutes writing time for the student, i.e., about two thirds of the time available. Descriptive questions should be carefully set so that students must indicate understanding of the particular subject.
e) Multi-part questions: These have many advantages but should conform broadly to the following principles-
i) Errors in an early part should not significantly prejudice the gaining of marks for subsequent parts
ii) A mixture of 'straightforward' and 'more difficult' parts may be used to adjust overall difficulty level. If possible, the easier parts should come first.
iii) The marking schedule should be even between parts unless stated otherwise, when the marks available should be clearly indicated
f) Model answers: Clearly written and well-presented model answers (solution set) are expected from examiners and should accompany the question paper when submitted.
g) Nature of the question paper should be precise. The paper setter should design the question paper such that the questions are unambiguous, are written in simple and meaningful words, should be asked for appropriate marks and should cover the entire syllabus prescribed for the course.
h) A scheme of marking, giving distribution of marks for different points in the question shall be included in the question paper for the guidance of the examinees as well as for the examiners assessing the answer books.
i) The paper setter should specifically mention the Charts, Tables, other documents / data books etc. The use of which shall be permitted during the actual conduct of the examination. Pre-printed data sheets maybe provided as per need, to be used by students during the examinations.
j) The faculty shall not write any instructions in the question paper that will violate the examination rules.

SET A

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Reg. No:

**End Semester Examination - December 2025**

| | | | |
|---|---|---|---|
| Programme | | Date of Examination | |
| Course Code | | Semester | |
| Course Name | | Total No. of Questions | |
| Class | | Pattern | **2023 REGULAR PATTERN** |
| Time | **2 hours** | Max. Marks | |

Instructions To Candidates

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed.
3. Black figures to the right indicate full marks.

**Bloom Level(BL):** 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

| **Answer the following Questions (Answer all Question (s) and all its parts only)** | **Marks** | **CO** | **BL** |
|---|---|---|---|
| **Q1.** | **10** | **1** | **2** |
| **Q2.** | **10** | **2** | **3** |
| **Q3.** | **10** | **3** | **3** |

In the TOS, first you have to plan the distribution of 100 marks into the respective COs.

| **CO Number** | **Marks** | |
|---|---|---|
| CO 1 | | L3 |
| CO 2 | | L3 |
| CO 3 | | L3 |
| CO 4 | | L6 |
| CO 5 | | L5 |
| **Total** | | |

Table 1

In Category 2, the distribution of questions for the respective COs in a tabular form should be presented.
Prepare 6 tables ( one for each CO)

CO 5: Explain software quality standards [L2]

| Cognitive level / Knowledge Domain | L1 remember | L2 Understand | L3 Apply | L4 Analyse | L5 Evaluate | L6 Create |
|---|---|---|---|---|---|---|
| Factual | | | | | | |
| Conceptual | | | | | | |
| Procedural | | | | | | |
| Meat Cognitive | | | | | | |

LOTS ( Lower Order Thinking skills)
HOTS (Higher Order thinking Skills)

The numbers written like 1 (2), where the first number indicate the question number and the number in bracket indicating the marks for the particular question.

Category 3: Distribution of marks as per the cognitive levels

| Cognitive Level | Marks | % |
|---|---|---|
| L1 Remember | | |
| L2 Understand | | |
| L3 Apply | | |
| L4 Analyse | | |
| L5 Evaluate | | |
| L6 Create | | |

This is combined input of all the 6 tables under category 2,

In the TOS(Table of Specification), first you have to plan the distribution of marks into the respective COs.

| CO Number | Marks |
|---|---|
| CO 1 | |
| CO 2 | |
| CO 3 | |
| CO 4 | |
| CO 5 | |
| **Total** | |

L3
L3 Table 1
L3 L6 L5

In Category 2, the distribution of questions for the respective COs in a tabular form should be presented. Prepare 6 tables ( one for each CO)

CO 4: Create Test cases for different testing techniques using testing tools[L6]

| Cognitive level / Knowledge Domain | L1 remember | L2 Understand | L3 Apply | L4 Analyse | L5 Evaluate | L6 Create |
|---|---|---|---|---|---|---|
| Factual | | | | | | |
| Conceptual | | | | | | |
| Procedural | | | | | | |
| Meat Cognitive | | | | | | |

LOTS ( Lower Order Thinking skills)
HOTS (Higher Order thinking Skills)

The numbers written like 1(2), where the first number indicate the question number and the number in bracket indicating the marks for the particular question.

Category 3: Distribution of marks as per the cognitive levels

| Cognitive Level | Marks | % |
|---|---|---|
| L1 Remember | | |
| L2 Understand | | |
| L3 Apply | | |
| L4 Analyse | | |
| L5 Evaluate | | |
| L6 Create | | |

This is combined input of all the 6 tables under category 2

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## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for Undergraduate Program Bachelor of Technology in Electronics and Telecommunication Engineering

(Choice Based Credit System)

**NEP REVISION**

(Four Year Curriculum W.E.F, AY: 2026-27)

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MIT | Academy of Engineering

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# INSTITUTE VISION

**To be a new age learning center for holistic development of students into professional engineers, to cater to the changing needs of techno-society.**

# INSTITUTE MISSION

- **To provide new-age infrastructural facilities blended with skill-based curriculum and activity-based pedagogical approaches to develop competitive engineering professionals to solve real-world problems.**
- **To prepare students for lifelong learning by transforming educational practices.**
- **To promote ethical and moral values by involving students in community services.**
- **To promote entrepreneurship and managerial skills by strengthening industry-institute interaction.**

# SCHOOL OF E&TC ENGINEERING

## VISION

**To develop the students towards an exemplary career in Telecommunication and its cognate disciplines, possessing a sound social awareness, sense of responsibility, and moral ethos.**

## MISSION

- **To develop the Department into a well-established education hub in the domain of Electronics & Telecommunication engineering.**
- **To provide students with a multi-faceted learning environment complemented by adequate engineering practice and research, preparing them to solve real-life engineering problems.**
- **To facilitate inclusive growth of all its student community and enabling them to be leaders of tomorrow.**

# PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

| PEO | PROGRAM EDUCATIONAL OBJECTIVES(PEO's) |
|---|---|
| PEO 1 | To achieve a high level of technical competence in the electronics and telecommunication domain or any other associated areas, be it an Engineering Practice or Research. |
| PEO 2 | To address real-world complex engineering problems by formulating solutions and designs that are technically sound, economically viable, practically feasible, and environmentally sustainable. |
| PEO 3 | To aim towards career enhancement by pursuing lifelong learning and evolve as a leader in professional and personal life. |

# PROGRAM OUTCOMES (PO's)

| PO | PROGRAM OUTCOMES (POs) |
|---|---|
| PO1 | **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| PO2 | **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| PO3 | **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations. |
| PO4 | **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| PO5 | **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| PO6 | **The Engineer and Society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| PO7 | **Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| PO8 | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| PO9 | **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| PO10 | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| PO11 | **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| PO12 | **Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

# PROGRAM SPECIFIC OBJECTIVES (PSO's)

| PSO | PROGRAM SPECIFIC OUTCOMES (PSO's) |
|---|---|
| PSO1 | Analyze and simulate diverse problems in the field of communication. |
| PSO2 | Design and analyze a system with applications in signal and image processing. |
| PSO3 | Build, test and evaluate an embedded system with real time constraints. |
| PSO4 | Design and implement a system towards automatic control in varied engineering problems |

## COMMON CURRICULUM FRAMEWORK (NEP Revision 2023 (2.0))

The Bachelor of Technology Program shall be based on the following type of courses.

| COURSE AND CREDIT DISTRIBUTION: SEMESTER-WISE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.N. | TYPE OF COURSE | NO. OF COURSES/SEMESTER (CREDITS) | | | | | | | | Total Courses | Total Credits | % |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | |
| 1. | Basic Science Courses (BSC) | 2(8) | 2(7) | | | | | | | 4 | 15 | 9 |
| 2. | Engineering Science (ESC) | 3(8) | 2(6) | | | | | | | 5 | 14 | 9 |
| 3. | Program Core Course (PCC) | | 1(2) | 3(10) | 3(10) | 2(8) | 2(8) | 1(4) | 1(4) | 13 | 46 | 27 |
| 4. | Program Elective Course (PEC) | | | | | 1(4) | 1(4) | 1(4) | 1(3) | 4 | 15 | 9 |
| 5 | Vocational and Skill Enhancement Course (VSEC) | 1(2) | 1(2) | 1(2) | 1(2) | 1(2) | 1(2) | | | 6 | 12 | 7 |
| 6 | Multi-Disciplinary Minor(MDM) | | | | 1(3) | 1(3) | 1(3) | 1(2) | 1(3) | 5 | 14 | 8 |
| 7 | Open Elective (OE) | | | 2(6) | | | | | 1(2) | 3 | 8 | 5 |
| 8 | Ability Enhancement Courses (HSSM AEC) | | 1(2) | | | | 1(2) | | | 2 | 4 | 2 |
| 9 | Management/Entrepreneurship /Economics Courses (HSSM MEC) | | | | 1(2) | | | 1(2) | | 2 | 4 | 2 |
| 10 | Indian Knowledge System (HSSM IKS) & Co-curricular (CC) | 2(3) | 1(2) | | | | | | | 3 | 5 | 3 |
| 11 | Value Education Course (HSSM VEC) | | | 1(3) | 1(2) | | | | | 2 | 5 | 3 |
| 12 | Experiential Learning/ Project/ Field Work/Community (ELC PRJ) | | | 1(1) | 1(1) | 1(2) | 1(2) | 2/1 (4/2) | 0/1 (0/2) | 6 | 10 | 6 |
| 13 | Experiential Learning Summer/ Semester Long Internship (ELC SI) | | | | 1(2) | 1(2) | | 1(4) | 1(8) | 4 | 16 | 10 |
| **Audit Courses** | | 1 | | | 1 | | | | | 2 | 0 | 0 |
| **TOTAL** | | 8 (21) | 8 (21) | 8 (22) | 9 (22) | 7 (21) | 7 (21) | 7 (20) | 5 (20) | 61 | 168 | 100 |

| CREDITS (CONTACT HOURS) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Lecture Hour = 1 Credit, 2 Lab Hours = 1 Credit, 1 Tutorial Hour = 1 Credit | | | | | | | | | | | | | | |
| SL. NO. | YEAR | SEMESTER CREDIT | | | SEMESTER CONTACT HOURS | | | | | | | | | |
| | | | | | 1 | | | 2 | | | TOTAL | | |
| | | 1 | 2 | TOTAL | TH | LAB | TUT | TH | LAB | TUT | TH | LAB | TUT |
| 1. | First Year | 21 | 21 | 42 | 14 | 12 | 1 | 14 | 16 | 1 | 28 | 28 | 2 |
| 2. | Second Year | 22 | 22 | 44 | 11 | 20 | 1 | 13 | 14 | 1 | 24 | 34 | 2 |
| 3. | Third Year | 21 | 21 | 42 | 11 | 16 | 0 | 11 | 20 | 0 | 22 | 36 | 0 |
| 4. | Final Year | 20 | 20 | 40 | 13(6) | 6(4) | 0 | 10 | 4 | 0 | 23 (16) | 10 (8) | 0 |
| TOTAL | | | | 168 | | | | | | | 97 (90) | 108 (106) | 4 |

| COURSE CATEGORIES ABBREVIATION | |
|---|---|
| BSC | Basic Science Course |
| ESC | Engineering Science Course |
| PCC | Programme Core Course |
| PEC | Programme Elective Course |
| MDM | Multi-Disciplinary Minor |
| OE | Open Elective |
| VSEC | Vocational and Skill Enhancement Course |
| HSSM AEC | Humanities Social Science Management Ability Enhancement Courses |
| HSSM MEC | Humanities Social Science Management/Entrepreneurship/ Economics Course |
| HSSM IKS | Humanities Social Science Management Indian Knowledge System |
| HSSM VEC | Humanities Social Science and Management Value Education Course |
| ELC PRJ | Experiential Learning Course Project/ Field Work/ Community Engagement Project |
| ELC SI | Experiential Learning Course Student's Internship (Summer/ Semester Long/ Year Long) |
| CC | Co-Curricular Courses |

| ABBREVIATIONS | | | |
|---|---|---|---|
| TH | Theory Lecture | ESE | End Semester Exam |
| P | Practical Lab | CA | Continuous Assessment |
| TU | Tutorial | T/P | Term Work / Practical |
| IA | Internal Assessment | DM | Demonstration |
| MSE | Mid Semester Exam | Lab | Laboratory |

MIT | Academy of Engineering

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## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# First Year

# Bachelor of Technology

# E&TC Engineering

## NEP REVISION 2023 (2.0)

(With Effect from Academic Year: 2026-2027)

**SEMESTER: I**

**2301119A - Universal Human Values (Induction Program)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT/TUT | | TOTAL | CREDIT |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| BSC | 2301101T | Calculus and Differential Equations | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301101U | Calculus and Differential Equations Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 |
| BSC | 2301104T | Science of Nature | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301104L | Science of Nature Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2304101T | Foundations of Computing | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2304101L | Foundations of Computing Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2303101T | Applied Mechanics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2303101L | Applied Mechanics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2309101T | Design Thinking | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2309101L | Design Thinking Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| VSEC | 2307161T | Electronics Workshop | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2307161L | Electronics Workshop Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| CC | 2301182L | Liberal Learning | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| HSSM IKS | 2307181T | Indian Knowledge System (Vedic Mathematics) | 2 | - | - | 25 | - | 50 | - | - | 75 | 2 |
| **TOTAL** | | | **14** | **12** | **1** | | | | | | **825** | **21** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | : | 2026-2027 |
| FIRST YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

| SEMESTER: II | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| BSC | 2301103T | Statistics and Integral Calculus | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2301103U | Statistics and Integral Calculus Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 | |
| BSC | 2301102T | Engineering Physics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2301102L | Engineering Physics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ESC | 2307102T | Introduction to Electrical & Electronics Engineering | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2307102L | Introduction to Electrical & Electronics Engineering Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ESC | 2304102T | Essentials of Data Science | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2304102L | Essentials of Data Science Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| VSEC | 2307162T | Integrating Sensors and Actuators | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 | |
| | 2307162L | Integrating Sensors and Actuators Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 | |
| PCC | 2307111T | Logic Sensing and Actuation | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| HMMS AEC | 2301111L | Communication Skills (English) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| | 2301112/ 3/4 T | Communication Skills (German/ Japanese/ French) | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 | |
| CC | 2307183L | Creative Technologies | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| TOTAL | | | 14 | 16 | 1 | | | | | | 825 | 21 | |

*Two Credit Internships need to be completed after Completion of the First Year.

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## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# Second Year

# Bachelor of Technology

# E&TC Engineering

## NEP REVISION 2023 (2.0)

(With Effect from Academic Year: 2027-2028)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2027-2028 |
| SECOND YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

| SEMESTER: III | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2307217T | Electronics Circuits and Applications | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2307217L | Electronics Circuits and Applications Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| PCC | 2307218T | Digital Systems Design | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2307218L | Digital Systems Design Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| PCC | 2307219T | Engineering Electromagnetics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2307219U | Engineering Electromagnetics Tutorial | - | - | 1 | - | - | - | - | 25 | 25 | 1 | |
| VSEC | 2307261L | Problem Solving Using OOP(C++) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| | 2307262L | Problem-Solving Using OOP (Java) | | | | | | | | | | | |
| | 2307264/5L | Discipline Skill Development Course | | | | | | | | | | | |
| HSSM VEC | 2301287 | Universal Human Values-II | 1 | 4 | - | - | - | 25 | - | 75 | 100 | 3 | |
| OE | 23BD251L | Prototyping | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| OE | 2301255T | Applied Mathematics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2301255L | Applied Mathematics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ELC PRJ | 2307291L | Project Design | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| TOTAL | | | 11 | 20 | 1 | | | | | | 825 | 22 | |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2027-2028 |
| SECOND YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

**SEMESTER: IV**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2307220T | ARM based Embedded System Design | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307220L | ARM based Embedded System Design Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2307221T | Principles of Communication Systems | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2307221L | Principles of Communication Systems lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2307222T | Circuit Theory | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2307222U | Circuit Theory Tutorial | - | - | 1 | - | - | - | - | 25 | 25 | 1 |
| VSEC | 2307263L | Data Structures | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| MDM | *MDM List | MDM Course-I | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | *MDM List | MDM Course-I Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| HSSM MEC | 2301276 | Entrepreneurship Skills | 1 | 2 | - | - | - | 25 | 20 | 30 | 75 | 2 |
| HSSM VEC | 2301286T | Environmental Science | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2307292L | Project Implementation | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ELC SI | 2307296L | Internship (Life And Soft Skills) | - | - | - | - | - | - | - | 75 | 75 | 2 |
| **Audit** | 2301281A | Indian Constitution | 1 | - | - | - | - | - | - | - | **Audit** | |
| **TOTAL** | | | **13** | **14** | **1** | | | | | | **850** | **22** |

*Two Credit Internships need to be completed after Completion of the Second Year.

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## MIT ACADEMY OF ENGINEERING, ALANDI

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# Third Year

# Bachelor of Technology

# E&TC Engineering

## NEP REVISION 2023 (2.0)

(With Effect from Academic Year: 2028-2029)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2028-2029 |
| THIRD YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

**SEMESTER: V**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2307311T | Computational Intelligence | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307311L | Computational Intelligence Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2307312T | Control Systems | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307312L | Control Systems Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PEC | 2307321T | Embedded Systems for IoT | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307321L | Embedded Systems for IoT Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2307322T | EV architecture and Dynamics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307322L | EV architecture and Dynamics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2307323T | Configurable Logic Design | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307323L | Configurable Logic Design Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| VSEC | 230736XL | Skill Courses | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| MDM | *MDM List | MDM Course-II | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | *MDM List | MDM Course-II Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ELC PRJ | 2307391L | Major Project - I | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2307396L | Internship (Technical) | - | - | - | - | - | - | - | 75 | 75 | 2 |
| TOTAL | | | 11 | 16 | - | | | | | | 800 | 21 |

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|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2028-2029 |
| THIRD YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

**SEMESTER: VI**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2307313T | Embedded Edge AI | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307313L | Embedded Edge AI Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2307314T | Digital Signal & Image Processing | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307314L | Digital Signal & Image Processing Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PEC | 2307324T | Introduction to Security of Cyber Physical Systems | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307324L | Introduction to Security of Cyber Physical Systems Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2307325T | Power Electronics in Electric Mobility | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307325L | Power Electronics in Electric Mobility Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2307326T | CMOS VLSI Design | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307326L | CMOS VLSI Design Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| VSEC | 230736XL | Skill Courses | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| MDM | *MDM List | MDM Course-III | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | *MDM List | MDM Course-III Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| HSSM AEC | 2301371L | Employability and Career Development | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC PRJ | 2307392L | Major Project - II | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| **TOTAL** | | | **11** | **20** | **-** | | | | | | **800** | **21** |

*Four Credit Internship needs to be completed after Completion of the Third Yea

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# MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

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# E&TC Engineering

## NEP REVISION 2023 (2.0)

(With Effect from Academic Year: 2029-2030)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2029-2030 |
| FINAL YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

**SEMESTER: VII (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2307411T | Advanced Neural Network Architectures | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 2307421T | Ubiquitous Sensing, Computing and Communication | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2307421L | Ubiquitous Sensing, Computing and Communication Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2307422T | Battery Management Systems for EV | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2307422L | Battery Management Systems for EV Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2307423T | Advance VLSI Design | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2307423L | Advance VLSI Design Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| MDM | *MDM List | Multidisciplinary Minor Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| HSSM MEC | 2307476T | Project Management | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2307491L | Major Project – III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC PRJ | 2307492T | Research Methodology | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC SI | 2307496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| **TOTAL** | | | **13** | **6** | **-** | | | | | | **750** | **20** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2029-2030 |
| FINAL YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
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| SEMESTER: VIII (PART A) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2307413T | Wireless Communication | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 | |
| PEC | 230742XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 | |
| | 2307SWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | | |
| MDM | *MDM List | Multidisciplinary Minor Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 | |
| | 2307SWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | | |
| OE | 230145XXL | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| ELC SI | 2307497L | Semester Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 | |
| | 2307498L | Student Outreach Programme | | | | | | | | | | | |
| | 2307493L | Capstone Portfolio | | | | | | | | | | | |
| TOTAL | | | 10 | 4 | | | | | | | 725 | 20 | |

*Credits earned in advance through a credit transfer scheme

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2029-2030 |
| FINAL YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

**SEMESTER: VII (PART B)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2307411T | Advanced Neural Network Architectures | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| MDM | *MDM List | Multidisciplinary Minor Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2307491L | Major Project – III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2307499L | Industry Practicum | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| ELC SI | 2307496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| TOTAL | | | 6 | 4 | - | | | | | | 750 | 20 |

**SEMESTER: VIII (PART B)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2307413T | Wireless Communication | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 230742XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2307SWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| MDM | *MDM List | Multidisciplinary Minor Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2307SWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| OE | 230145XXL | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2307497L | Semester Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 2307498L | Student Outreach Programme | | | | | | | | | | |
| | 2307493L | Capstone Portfolio | | | | | | | | | | |
| TOTAL | | | 10 | 4 | | | | | | | 725 | 20 |

*Credits earned in advance through a credit transfer scheme

| Program | Exit after | Courses | Credits | Total |
|---|---|---|---|---|
| Electronics and Telecomm. / Electronics Engineering | First Year | Internship | 4 | 8 |
| | | Embedded System design | 4 | |
| | Second Year | Internship | 4 | 8 |
| | | Embedded System Design | 4 | |
| | Third Year | Internship | 4 | 8 |
| | | Industry 4.0 | 4 | |

| Basic Science Courses (BSC): 4 Courses and 15 Credits | | | |
|---|---|---|---|
| Sl. No. | Course Code | Course Name | Course Credits |
| 1. | 2301101T | Calculus and Differential Equations | 3 |
| | 2301101U | Calculus and Differential Equations Tutorial | 1 |
| 2. | 2301102T | Engineering Physics | 2 |
| | 2301102L | Engineering Physics Lab | 1 |
| 3. | 2301103T | Statistics and Integral Calculus | 3 |
| | 2301103U | Statistics and Integral Calculus Tutorial | 1 |
| 4. | 2301104T | Science of Nature | 3 |
| | 2301104L | Science of Nature Lab | 1 |

| Engineering Science (ESC): 5 Courses and 14 Credits | | | |
|---|---|---|---|
| Sl. No. | Course Code | Course Name | Course Credits |
| 1. | 2307102T | Introduction to Electrical & Electronics Engineering | 2 |
| | 2307102L | Introduction to Electrical & Electronics Engineering Lab | 1 |
| 2. | 2304101T | Foundations of Computing | 2 |
| | 2304101L | Foundations of Computing Lab | 1 |
| 3. | 2304102T | Essentials of Data Science | 2 |
| | 2304102L | Essentials of Data Science Lab | 1 |
| 4. | 2303101T | Applied Mechanics | 2 |
| | 2303101L | Applied Mechanics Lab | 1 |
| 5. | 2309101T | Design Thinking | 1 |
| | 2309101L | Design Thinking Lab | 1 |

| Program Core Course (PCC): 13 Courses and 46 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2307111T | Logic Sensing and Actuation | 2 |
| 2. | 2307217T | Electronics Circuits and Applications | 3 |
| | 2307217L | Electronics Circuits and Applications Lab | 1 |
| 3. | 2307218T | Digital Systems Design | 2 |
| | 2307218L | Digital Systems Design Lab | 1 |
| 4. | 2307219T | Engineering Electromagnetics | 2 |
| | 2307219U | Engineering Electromagnetics Tutorial | 1 |
| 5. | 2307220T | ARM based Embedded System Design | 3 |
| | 2307220L | ARM based Embedded System Design Lab | 1 |
| 6. | 2307221T | Principles of Communication Systems | 2 |
| | 2307221L | Principles of Communication Systems Lab | 1 |
| 7. | 2307222T | Circuit Theory | 2 |
| | 2307222U | Circuit Theory Tutorial | 1 |
| 8. | 2307311T | Computational Intelligence | 3 |
| | 2307311L | Computational Intelligence Lab | 1 |
| 9. | 2307312T | Control Systems | 3 |
| | 2307312L | Control Systems Lab | 1 |
| 10. | 2307313T | Embedded Edge AI | 3 |
| | 2307313L | Embedded Edge AI Lab | 1 |
| 11. | 2307314T | Digital Signal & Image Processing | 3 |
| | 2307314L | Digital Signal & Image Processing Lab | 1 |
| 12. | 2307411T | Advanced Neural Network Architectures | 4 |
| 13. | 2307413T | Wireless Communication | 4 |

| Program Elective Course (PEC): 4 Courses and 15 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2307321T | Embedded Systems for IoT | 3 |
| | 2307321L | Embedded Systems for IoT Lab | 1 |
| | 2307324T | Introduction to Security of Cyber Physical Systems | 3 |
| | 2307324L | Introduction to Security of Cyber Physical Systems Lab | 1 |
| | 2307421T | Ubiquitous Sensing, Computing and Communication | 3 |
| | 2307421L | Ubiquitous Sensing, Computing and Communication Lab | 1 |
| | 2307SWXX | SWAYAM Course | 3 |
| 2. | 2307322T | EV architecture and Dynamics | 3 |
| | 2307322L | EV architecture and Dynamics Lab | 1 |
| | 2307325T | Power Electronics in Electric Mobility | 3 |
| | 2307325L | Power Electronics in Electric Mobility Lab | 1 |
| | 2307422T | Battery Management Systems for EV | 3 |
| | 2307422L | Battery Management Systems for EV Lab | 1 |
| | 2307SWXX | SWAYAM Course | 3 |

| | | | |
|---|---|---|---|
| 3. | 2307323T | Configurable Logic Design | 3 |
| | 2307323L | Configurable Logic Design Lab | 1 |
| | 2307326T | CMOS VLSI Design | 3 |
| | 2307326L | CMOS VLSI Design Lab | 1 |
| | 2307423T | Advance VLSI Design | 3 |
| | 2307423L | Advance VLSI Design Lab | 1 |
| | 2307SWXX | SWAYAM Course | 3 |

| List of SWAYAM Courses | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 23XXSW0X | SWAYAM Course | 3 |
| 2 | 23XXSW0X | SWAYAM Course | |
| 3. | 23XXSW0X | SWAYAM Course | |
| 4. | 23XXSW0X | SWAYAM Course | |
| 5. | 23XXSW0X | SWAYAM Course | |
| 6. | 23XXSW0X | SWAYAM Course | |

| Vocational and Skill Enhancement Course (VSEC): 6 Courses and 12 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2307161T | Electronics Workshop | 1 |
| | 2307161L | Electronics Workshop Lab | 1 |
| 2. | 2307162T | Integrating Sensors and Actuators | 1 |
| | 2307162L | Integrating Sensors and Actuators Lab | 1 |
| 3. | 2307261L | Problem-Solving Using OOP (C++) | 2 |
| | 2307262L | Problem-Solving Using OOP (Java) | |
| | 2307264/5L | Discipline Skill Dev. Course | |
| 4. | 2307263L | Data Structures | 2 |
| 5. | 2307361L | Database Management Systems (DBMS) Lab | 2 |
| | 2307362L | Linux for Embedded Systems Lab | |
| | 2307363L | MERN Stack Web Development-IR4.0 Foundation | |
| | 2307370L | Introduction to Programming (ITPR) | |
| | 230736XL | Professional Certification Course | |
| 6. | 2307364L | RTOS on ARM Processor Lab | 2 |
| | 2307365L | Computer Network Lab | |
| | 2307366L | Model Based Design (MBD) Lab | |
| | 2307367L | Cloud Computing Lab | |
| | 2307368L | Advance Data Science Lab | |
| | 2307369L | Applied Artificial Intelligence: Practical Implementations | |

| List of Vocational Skill Enhancement Course (VSEC): 6 Courses and 12 Credit | | | | | | |
|---|---|---|---|---|---|---|
| **Programme Name** | **VSEC Course 1** | **VSEC Course 2** | **VSEC Course 3** | **VSEC Course 4** | **VSEC Course 5** | **VSEC Course 6** |
| **Electronics Engineering** | Electronics Workshop | Integrating Sensors and Actuators | Problem Solving Using OOP (C++/Java) | Data Structures | Database Management System (DBMS) / Linux for Embedded Systems Lab / MERN Stack Web Development- IR4.0 Foundation | RTOS on ARM Processor / Computer Network/ Model Based Design (MBD)/ Cloud Computing/Advance Data Science/ Applied Artificial Intelligence: Practical Implementations |
| **Electronics & Telecommunication Engineering** | Electronics Workshop | Integrating Sensors and Actuators | Problem Solving Using OOP (C++/Java) | Data Structures | Database Management System (DBMS) / Linux for Embedded Systems Lab / MERN Stack Web Development- IR4.0 Foundation | RTOS on ARM Processor / Computer Network/ Model Based Design (MBD)/ Cloud Computing/Advance Data Science/ Applied Artificial Intelligence: Practical Implementations |

| Open Elective (OE): 3 Courses and 8 Credits | | | | |
|---|---|---|---|---|
| **Sl. No.** | **Offering School** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | SHES (Mathematics) | 2301251T | Applied Mathematics | 3 |
| | | 2301251L | Applied Mathematics Lab | 1 |
| | | 2301252T | Applied Mathematics | 3 |
| | | 2301252L | Applied Mathematics Lab | 1 |
| | | 2301253T | Applied Mathematics | 3 |
| | | 2301253L | Applied Mathematics Lab | 1 |
| | | 2301254T | Applied Mathematics | 3 |
| | | 2301254L | Applied Mathematics Lab | 1 |
| | | 2301255T | Applied Mathematics | 3 |
| | | 2301255L | Applied Mathematics Lab | 1 |
| | | 2301256T | Applied Mathematics | 3 |
| | | 2301256L | Applied Mathematics Lab | 1 |
| | | 2301257T | Applied Mathematics | 3 |
| | | 2301257L | Applied Mathematics Lab | 1 |
| 2. | B. Design | 23BD251T | Prototyping | 2 |
| 3. | SHES | 230145XXL | Professional Certification Courses | 2 |

| Humanities Social Science and Management Ability Enhancement Courses (HSS AEC): 2 Courses and 4 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301111/2/3/4 | Communication Skills (English/ German/Japanese/French) | 2 |
| 2. | 2301371L | Employability and Career Development | 2 |

| Humanities Social Science Management/Entrepreneurship/Economics(HSS MEC): 2 Courses and 4 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301276 | Entrepreneurship Skills | 2 |
| 2. | 2307476T | Project Management | 2 |

| Humanities Social Science and Management Value Education Course (HSSM VEC): 3 Courses and 5 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301119A | Universal Human Values-I | Audit |
| 2. | 2301286T | Environmental Science | 2 |
| 3. | 2301287 | Universal Human Values-II | 3 |

| Humanities Social Science and Management Indian Knowledge System / Co-Curricular Courses (HSSM IKS / CC): 4 Courses and 5 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2307181T | Indian Knowledge System - (Vedic Mathematics) | 2 |
| 2. | 2301182L | Liberal Learning - (HSSM CC) | 1 |
| 3. | 2307183L | Creative Technologies - (HSSM CC) | 2 |
| 4. | 2301281A | Indian Constitution | Audit |

| Experiential Learning Course Project/Field Work/Community Project(ELC PRJ): 6 Courses and 10 Credit | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2307291L | Project Design | 1 |
| 2. | 2307292L | Project Implementation | 1 |
| 3. | 2307391L | Major Project - I | 2 |
| 4. | 2307392L | Major Project - II | 2 |
| 5. | 2307491L | Major Project - III | 2 |
| 6. | 2307492T | Research Methodologies | 2 |
| Optional | 2307493L | Capstone Portfolio | 8 |

| Experiential Learning Course Student's Internship (Summer/Semester Long) (ELC SI): 4 Courses and 16 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2307296L | Internship (Life And Soft Skills) | 2 |
| 2. | 2307396L | Internship (Technical) | 2 |
| 3. | 2307496L | Summer Internship (Technical) | 4 |
| 4. | 2307497L | Semester Long Internship | 8 |
| Optional | 2307498L | Student Outreach Programme | 8 |
| Optional | 2307499L | Industry Practicum | 8 |

| Multi-Disciplinary Minor (MDM) List: 05 Courses and 14 Credits | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Programme Name | Track Name | Semester IV (MDM-I, 3 Credits) | | Semester V (MDM-II, 3 Credits) | | Semester VI (MDM-III, 3 Credits) | | Semester VII (MDM-IV, 2 Credits) | | Semester VIII (MDM-V, 3 Credits) | |
| | | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name |
| Chemical Engineering | Chemical Engineering (Green Technology and Sustainability Engineering) | 2301232 (T+L) | Engineering Informatics (T+L) | 2305331 (T+L) | Sustainability & Green Technology (T+L) | 2305332 (T+L) | Sustainable Bio-energy and Bio-products (T+L) | 2305431T | Green energy conversion systems | 2305SWXX | SWAYAM Course |
| | Chemical Engineering (Industrial Technology Management) | 2301232 (T+L) | Engineering Informatics (T+L) | 2305333 (T+L) | Management of Technology (T+L) | 2305334 (T+L) | Product Management (T+L) | 2305432T | Product Design and Process Development | 2305SWXX | SWAYAM Course |
| Civil Engineering | Civil Engineering (Infrastructure and Sustainability | 2301232 (T+L) | Engineering Informatics (T+L) | 2303331 (T+L) | Smart Cities (T+L) | 2303332 (T+L) | Sustainable Engineering (T+L) | 2303431T | Integrated Environmental Planning & Assessment | 2303SWXX | SWAYAM Course |
| Computer Engineering | Computer Engineering | 2301232 (T+L) | Engineering Informatics (T+L) | 2304331 (T+L) | Data Structures & Algorithms (T+L) | 2304332 (T+L) | Database Management Systems (T+L) | 2304431T | Software Engineering | 2304SWXX | SWAYAM Course |
| Software Engineering | Software Engineering | 2301232 (T+L) | Engineering Informatics (T+L) | 2310331 (T+L) | Software Architecture (T+L) | 2310332 (T+L) | Software Testing (T+L) | 2310431T | Software Quality Management | 2310SWXX | SWAYAM Course |
| Computer Science & Engineering (AIML) | Artificial Intelligence and Machine Learning | 2301232 (T+L) | Engineering Informatics (T+L) | 2311331 (T+L) | Artificial Intelligence & Machine Learning (T+L) | 2311332 (T+L) | Deep Learning (T+L) | 2311431T | Generative AI | 2311SWXX | SWAYAM Course |
| | Healthcare Technologies | 2301232 (T+L) | Engineering Informatics (T+L) | 2311333 (T+L) | Fundamentals of Healthcare Technologies (T+L) | 2311334 (T+L) | Healthcare Informatics (T+L) | 2311432T | AI in Healthcare | 2311SWXX | SWAYAM Course |

| Multi-Disciplinary Minor (MDM) List: 05 Courses and 14 Credits | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Programme Name | Track Name | Semester IV (MDM-I, 3 Credits) | | Semester V (MDM-II, 3 Credits) | | Semester VI (MDM-III, 3 Credits) | | Semester VII (MDM-IV, 2 Credits) | | Semester VIII (MDM-V, 3 Credits) | |
| | | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name |
| Computer Science & Engineering (DS) | Data Science | 2301232 (T+L) | Engineering Informatics (T+L) | 2312331 (T+L) | Data Analytics (T+L) | 2312332 (T+L) | Predictive Analytics (T+L) | 2312431T | Big Data Analytics | 2312SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| Information Technology | Cloud Computing | 2301232 (T+L) | Engineering Informatics (T+L) | 2308331 (T+L) | Cloud Computing Foundations (T+L) | 2308332 (T+L) | Cloud-Native Application Development (T+L) | 2308431T | Cloud Native DevOps | 2308SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| Electronics Engineering | Blockchain Technologies | 2301232 (T+L) | Engineering Informatics (T+L) | 2306331 (T+L) | Cyber Security Essentials (T+L) | 2306332 (T+L) | Network Security (T+L) | 2306431T | Blockchain Technology and Applications | 2306SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| Mechanical Engineering | Computer Aided Engineering and Automation | 2301232 (T+L) | Engineering Informatics (T+L) | 2309331 (T+L) | CAD Automation and Customization (T+L) | 2309332 (T+L) | Computer Aided Simulation (T+L) | 2309431T | Industrial Automation | 2309SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| SHES (Entrepreneurship) | Innovation and Entrepreneurship | 2301232 (T+L) | Engineering Informatics (T+L) | 2301331 (T+L) | Foundation of Entrepreneurship | 2301332 (T+L) | Venture Development | 2301431T | Startup Incubation & Fund Raising | 2301SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| MITACSC | Business Administration | 2301232 (T+L) | Engineering Informatics (T+L) | 2301333 (T+L) | Principles and Practices of Management | 2301334 (T+L) | Organizational Behavior | 2301432T | Managerial Economics | 2301SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| SHES | Lean Management | 2301232 (T+L) | Engineering Informatics (T+L) | 2301335 (T+L) | Foundations of Lean Manufacturing Process | 2301336 (T+L) | Advance Lean manufacturing | 2301433T | Lean Manufacturing Project | 2301SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| B. Design | Design for Engineers | 2301232 (T+L) | Engineering Informatics (T+L) | 23BD331 (T+L) | Design Fundamentals | 23BD332 (T+L) | Packaging Design | 23BD431T | Introduction to UI-UX | 23BDSWXX | SWAYAM Course |

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# First Year

# Bachelor of Technology

# E&TC Engineering

## NEP REVISION 2023 (2.0)

(With Effect from Academic Year: 2026-2027)

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | : | 2026-2027 |
| FIRST YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

**SEMESTER: I**

**2301119A - Universal Human Values (Induction Program)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT/TUT | | TOTAL | CREDIT |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| BSC | 2301101T | Calculus and Differential Equations | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301101U | Calculus and Differential Equations Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 |
| BSC | 2301104T | Science of Nature | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301104L | Science of Nature Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2304101T | Foundations of Computing | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2304101L | Foundations of Computing Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2303101T | Applied Mechanics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2303101L | Applied Mechanics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2309101T | Design Thinking | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2309101L | Design Thinking Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| VSEC | 2307161T | Electronics Workshop | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2307161L | Electronics Workshop Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| CC | 2301182L | Liberal Learning | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| HSSM IKS | 2307181T | Indian Knowledge System (Vedic Mathematics) | 2 | - | - | 25 | - | 50 | - | - | 75 | 2 |
| TOTAL | | | 14 | 12 | 1 | | | | | | 825 | 21 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | : | 2026-2027 |
| FIRST YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

| SEMESTER: II | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| BSC | 2301103T | Statistics and Integral Calculus | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2301103U | Statistics and Integral Calculus Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 | |
| BSC | 2301102T | Engineering Physics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2301102L | Engineering Physics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ESC | 2307102T | Introduction to Electrical & Electronics Engineering | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2307102L | Introduction to Electrical & Electronics Engineering Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ESC | 2304102T | Essentials of Data Science | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2304102L | Essentials of Data Science Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| VSEC | 2307162T | Integrating Sensors and Actuators | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 | |
| | 2307162L | Integrating Sensors and Actuators Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 | |
| PCC | 2307111T | Logic Sensing and Actuation | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| HMMS AEC | 2301111L | Communication Skills (English) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| | 2301112/ 3/4 T | Communication Skills (German/ Japanese/ French) | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 | |
| CC | 2307183L | Creative Technologies | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| TOTAL | | | 14 | 16 | 1 | | | | | | 825 | 21 | |

*Two Credit Internships need to be completed after Completion of the First Year.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2026 - 2027 (Rev. 2023 (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Calculus and Differential Equations |
| | **COURSE CODE** | 2301101T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301101T.CEO.1: To apply the concepts of partial differentiation.
2301101T.CEO.2: Demonstrate an understanding towards the applications of partial differentiation.
2301101T.CEO.3: Examine methods for solving first-order first-degree ordinary differential equations.
2301101T.CEO.4: Infer the applications of first-order differential equations.
2301101T.CEO.5: Determine the solution of linear differential equations of second and higher order.
2301101T.CEO.6: Solve first-order linear and nonlinear partial differential equations.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301101T.CO.1: Make use of properties of partial differentiation to solve the problems [L3].
2301101T.CO.2: Examine the applications of partial differentiation [L4].
2301101T.CO.3: Solve first-order and first-degree ordinary differential equations [L2].
2301101T.CO.4: Analyze real-world phenomenon governed by first-order ordinary differential equations [L4].
2301101T.CO.5: Apply concepts of solving linear differential equations of second and higher order governing different systems in engineering [L4].
2301101T.CO.6: Determine solutions of various partial differential equations by theoretical methods [L3].

## COURSE ABSTRACT

The course focuses on developing important mathematical concepts in a comprehensible, coherent and rigorous way. This is achieved by means of a carefully balanced approach by including the topics of calculus and differential equations which will foster the analytical thinking, and problem solving abilities of the students. Students are encouraged to apply their mathematical knowledge to solve problems and clear their doubts through tutorial sessions. Students embarking on this course will be able to identify and solve various differential equation problrms and will be intellectually equipped with the links between these concepts and their core engineering and real life problems. This course will enable them to tackle the problems of differential equations that they encounter in other engineering courses.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Partial Differentiation** | **08 HOURS** |

**Contents:** Partial Differentiation: Introduction, Chain rule, Total derivative, Change of variables, Homogeneous functions, Euler's theorem, Differentiation of implicit functions.
**Self Study:** Differentiation of implicit functions.

| | | |
|---|---|---|
| **UNIT 2** | **Applications Of Partial Differentiation** | **07 HOURS** |

**Applications/Case Study:** Maxima, Minima.
**Contents:** Jacobian, Jacobian of implicit functions, Partial derivative of an implicit function using Jacobians, Functional dependence, Maxima and Minima of functions of two variables.
**Self Study:** Jacobian of implicit functions.

| | | |
|---|---|---|
| **UNIT 3** | **Ordinary Differential Equations Of First Order And First Degree** | **07 HOURS** |

**Contents:** Exact differential equations, Differential equations, Reducible to exact form-Integrating factors, Linear differential equations, Differential equations reducible to linear form.
**Self Study:** Differential equations reducible to linear form.

| | | |
|---|---|---|
| **UNIT 4** | **Applications Of Ordinary Differential Equations Of First Order & First Degree** | **07 HOURS** |

**Applications/Case Study:** Electrical circuits.
**Contents:** Orthogonal trajectories, Newton's law of cooling, Growth & Decay, Electric circuits, Chemical applications- Mixing problems.
**Self Study:** Newton's law of cooling, Growth & Decay.

| | | |
|---|---|---|
| **UNIT 5** | **Linear Differential Equation Of Second Order & Higher Order** | **08 HOURS** |

**Applications/Case Study:** Mass-Spring systems.
**Contents:** General solutions of linear differential equations with constant coefficients,Shortcut methods to find P.I., Method of variation of parameters, Equations reducible to linear differential equations with constant coefficients: Cauchy and Legendre's linear differential equations.
**Self Study:** Cauchy and Legendre's linear differential equations.
**Further Readings:** Simultaneous differnetial equations, Applications in Electric circuits, Mass-Spring systems etc.

| UNIT 6 | Partial Differential Equations | 08 HOURS |
|---|---|---|

**Contents:** Introduction and formation of a partial differential equation, solution of a partial differential equation, equations solvable by direct integration, Linear differential equations of the first order, Non-linear differential equations of the first order, Charpit's method.

**Further Readings:** Linear Homogeneous Partial Differential Equations.

## TEXT BOOKS


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.
2. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.


## REFERENCE BOOKS


1. Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379-8858). Addison-Wesley.
2. Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.
3. Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.
4. O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.
5. Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: 2026 - 2027 (Rev. 2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Calculus and Differential Equations Tutorial |
| | COURSE CODE | 2301101U |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 1 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2301101U.CEO.1: To apply the concepts of partial differentiation.
2301101U.CEO.2: Demonstrate an understanding towards the applications of partial differentiation.
2301101U.CEO.3: Examine methods for solving first-order first-degree ordinary differential equations.
2301101U.CEO.4: Infer the applications of first-order differential equations.
2301101U.CEO.5: Determine the solution of linear differential equations of second and higher order.
2301101U.CEO.6: Solve first-order linear and nonlinear partial differential equations.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301101U.CO.1: Make use of properties of partial differentiation to solve the problems [L3].
2301101U.CO.2: Examine the applications of partial differentiation [L4].
2301101U.CO.3: Solve first-order and first-degree ordinary differential equations [L2].
2301101U.CO.4: Analyze real-world phenomenon governed by first-order ordinary differential equations [L4].
2301101U.CO.5: Apply concepts of solving linear differential equations of second and higher order governing different systems in engineering [L4].
2301101U.CO.6: Determine solutions of various partial differential equations by theoretical methods [L3].

## COURSE ABSTRACT

The course focuses on developing important mathematical concepts in a comprehensible, coherent and rigorous way. This is achieved by means of a carefully balanced approach by including the topics of calculus and differential equations which will foster the analytical thinking, and problem solving abilities of the students. Students are encouraged to apply their mathematical knowledge to solve problems and clear their doubts through tutorial sessions. Students embarking on this course will be able to identify and solve various differential equation problrms and will be intellectually equipped with the links between these concepts and their core engineering and real life problems. This course will enable them to tackle the problems of differential equations that they encounter in other engineering courses.

## TUTORIALS

| | | |
|---|---|---|
| **TUTORIAL NO.01** | **Partial Differentiation** | **01 HOUR** |
| Problems On Partial Differentiation: Introduction, Chain rule, Total derivative, Change of variables. | | |
| **TUTORIAL NO.02** | **Partial Differentiation** | **01 HOUR** |
| Problems On Homogeneous functions, Euler's Theorem, Differentiation of Implicit functions. | | |
| **TUTORIAL NO.03** | **Applications of Partial Differentiation** | **01 HOUR** |
| Problems on Jacobian, Jacobian of Implicit functions, Partial derivative of an implicit function. | | |
| **TUTORIAL NO.04** | **Applications of Partial Differentiation** | **01 HOUR** |
| Problems on Functional dependence, Maxima and Minima of functions of two variables. | | |
| **TUTORIAL NO.05** | **Ordinary Differential Equations** | **01 HOUR** |
| Problems on Exact differential equations, Differential equations reducible to exact form-Integrating factors. | | |
| **TUTORIAL NO.06** | **Ordinary Differential Equations** | **01 HOUR** |
| Linear differential equations, Differential equations reducible to linear form. | | |
| **TUTORIAL NO.07** | **Applications of Ordinary Differential Equations** | **01 HOUR** |
| Orthogonal Trajectories, Newton's law of cooling, Growth & Decay. | | |
| **TUTORIAL NO.08** | **Applications of Ordinary Differential Equations** | **01 HOUR** |
| Electric circuits, Chemical applications- Mixing problems. | | |
| **TUTORIAL NO.09** | **Linear Differential Equations of Higher Order** | **01 HOUR** |
| General solutions of linear differential equations with constant coefficients, Shortcut methods to find P.I. | | |
| **TUTORIAL NO.10** | **Linear Differential Equations of Higher Order** | **01 HOUR** |
| Shortcut methods to find P.I., Method of variation of parameters, Cauchy and Legendre's linear differential equation. | | |

| TUTORIAL NO.11 | Partial Differential Equations | 01 HOUR |
|---|---|---|
| Introduction and formation of partial differential equation, solution of a partial differential equation, equations solvable by direct integration. | | |
| **TUTORIAL NO.12** | **Partial Differential Equations** | **01 HOUR** |
| Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method. | | |
| **TUTORIAL NO.13** | **Guest Lecture** | **02 HOUR** |
| Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method. | | |
| **TUTORIAL NO.14** | **Doubt Clearing Session** | **01 HOUR** |
| Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method. | | |

## TEXT BOOKS


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.
2. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.


## REFERENCE BOOKS


1. Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379-8858). Addison-Wesley.
2. Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.
3. Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.
4. O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.
5. Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF CHEMICAL ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev. 2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Science of Nature |
| | COURSE CODE | 2301104T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2301104T.CEO.1: Make students conversant with basic Biology regarding the life processes.

2301104T.CEO.2: Study biology and engineering as biologically inspired technologies like designs in nature, bioenergetics, bioprocesses, biomaterials, biomechanics, and bioinstrumentation.

2301104T.CEO.3: To define the role of chemistry for engineers via atomic structure and green chemistry principles.

2301104T.CEO.4: To define the basic aspects and applications of polymers, biomaterials & composites.

2301104T.CEO.5: To illustrate the basic principles, instrumentation & applications of analytical techniques.

2301104T.CEO.6: To outline the technology involved in improving quality of water for its industrial use.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301104T.CO.1: Illustrate natural biological processes and their technical aspects that changed human life by applying engineering principles [L2].

2301104T.CO.2: Explain the impact of chemical bonding on engineering materials and properties [L2].

2301104T.CO.3: Demonstrate proficiency in applying green chemistry principles to engineering solutions [L2].

2301104T.CO.4: Make use of advanced instrumental methods for the analysis of chemical compounds [L3].

2301104T.CO.5: Analyze information from case studies and applications to strategize solutions for complex real-world engineering challenges [L4].

## COURSE ABSTRACT

The fundamental objective of the Science of Nature course is to provide the extended knowledge of chemistry & biology required for engineering courses. The course defines the role of chemistry for engineers via topics like atomic structure & green chemistry principles. A few topics like Formation of Materials which covers chemical bonding and their influence on chemical properties & Engineering materials are included. This enables students to understand the application of chemistry in electronic gadgets, in construction, chemical compounds as a conducting materials, as smart materials, as nano materials viz carbon nano materials etc. Further, the analysis part involves various instrumental methods. It is aimed to give information about the advanced characterization and separation techniques of chemical compounds. The biology part of the course includes phenomena observed in nature viz., Physical, Chemical and Biological along with the case studies and applications. This gives much needed information about natural biological processes and their technical aspects in view of optimizing Engineering solutions. This promotes the applicability of engineering in understanding of chemistry/biology and visa-versa.

## THEORY COURSE CONTENTS

| UNIT 1 | Introduction to Science of Nature | 8 HOURS |
|---|---|---|

**Contents:** The basics of science of nature. Exploring science in nature, specially symmetry, spiral, golden ratio, pattern and fractal. The phenomenon observed in nature viz., Physical, Chemical and Biological. Case studies and Applications. The diversity and commonality of cells, protein structure and function, basic molecular genetic mechanisms, bio membranes and cell architecture, transport of ions and small molecules across Cell membranes, cellular energetics, cell birth, lineage and death.

**Self Study:** Physiological activities.

| UNIT 2 | Applications of Biology | 7 HOURS |
|---|---|---|

Physiologic Systems - An Outline of Cardiovascular Structure and Function, Endocrine System, Nervous System, Vision System, Defense mechanisms in plants and animals. Introduction to Bio Sensors, Performance Factors, Factors Affecting the Performance of Sensors, Areas of Application. Biological Sensing Elements, Biological transducers. Discovery and Innovations in applications of Biology. **Self Study:** Locomotion.

| UNIT 3 | The Role of Chemistry for Engineers | 8 HOURS |
|---|---|---|

**Applications/Case Study:** Hydrogen Spectrum.

(A) **Introduction:** This section is an introduction to chemistry and chemical methods for engineering students. It describes how chemistry is used in engineering and how chemical principles aid engineers in the choice of materials for a particular application. Principles of Green chemistry are reviewed. The classification of separation methods used for mixtures. (B) **Periodic Table:** This section covers the names and symbols of the elements. The basic structure of the atom is reviewed including an explanation of isotopes. A discussion of the atomic structure describes electronic shells, subshells, their quantum numbers, orbital shapes, electron filling order, and the determination of the complete electron configuration of the elements. General description of the modern periodic table. Correlation between the valence electron configurations and the chemical properties of the elements. The periodic trends according to the position of the elements in the periodic table.

**Self Study:** Slater's rule for ion.

| UNIT 4 | Chemical Bonding - The Formation of Materials | 9 HOURS |
|---|---|---|

(A) **The Formation of Materials:** This section covers chemical bonding and its effect on the chemical properties of the elements. Ionic bonding & covalent bonding are compared in terms of the octet rule and valence bond theory. Polar and non-polar covalent bonds. Molecular orbital theory is introduced to explain magnetism, bond order and hybridization helpful in Carbon chemistry. Intermolecular forces, including hydrogen bonding, are discussed with a special Case Study focusing on the special properties of water.

(B) **Engineering Materials:** This section covers the Resources of Natural Materials, Introduction to Material Sciences viz. Polymers, Specialty polymers, Biomaterials, Nano materials and Smart materials with their examples and applications.

**Self Study:** Real life applications of smart materials.

| UNIT 5 | Chemical Analysis and Instrumentation | 7 HOURS |
|---|---|---|

This chapter covers some of the more common instrumental methods used for the qualitative and quantitative analysis of materials. The principles of chromatography are introduced with paper chromatography and later applied to thin layer chromatography, pH-metry and Conductometry are reviewed as a few important and basic methods for analysis of chemical compounds and a case study on the analysis of water samples is given as an example. UV-visible absorption spectroscopy is reviewed as one of the sophisticated analytical techniques.

**Self Study:** Applications in Bio-medical field.

| UNIT 6 | Water Treatment and Effluent Management | 6 HOURS |
|---|---|---|

**Applications/Case Study:** Water analysis of river Indrayani.

This chapter covers types of impurities in water & the conventional water treatment methods. Hardness, Alkalinity and Chloride content of water, its causes, types and volumetric methods for their determinations are reviewed along with numerical. Various water softening & treatment methods which includes filtration methods by Carbon adsorption, ion-exchange methods and membrane techniques are explained.

## TEXT BOOKS


1. Jain, P. C., & Jain, M. (1998). Engineering Chemistry: Chemistry of Engineering Materials. Dhanpat Rai Pub. Com.
2. Khopkar, S. M. (2008). Basic of Concept of Analytical Chemistry; 3 rd Edn; New AGF International Pvt. Ltd. Publisher, New Delhi, 1-5.
3. Chauhan, B. S. (2008). Engineering Chemistry. Laxmi Publications, Ltd..
4. Lodish, H., Berk, A., Kaiser, C. A., Kaiser, C., Krieger, M., Scott, M. P., ... & Matsudaira, P. (2008). Molecular cell biology. Macmillan.


## REFERENCE BOOKS


1. Gaffney, J., & Marley, N. (2017). General chemistry for engineers. Elsevier.
2. Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2013). Fundamentals of analytical chemistry. Cengage learning.
3. Willard, H. H., Merritt Jr, L. L., Dean, J. A., & Settle Jr, F. A. (1988). Instrumental methods of analysis.
4. Pradeep, T. (2012). Textbook of nanoscience and nanotechnology. McGraw-Hill Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF CHEMICAL ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev. 2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Science of Nature Lab |
| | COURSE CODE | 2301104L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2301104L.CEO.1: Make students conversant with basic Biology regarding the life processes.

2301104L.CEO.2: Study biology and engineering as biologically inspired technologies like designs in nature, bioenergetics, bioprocesses, biomaterials, biomechanics, and bioinstrumentation.

2301104L.CEO.3: To define the role of chemistry for engineers via atomic structure and green chemistry principles.

2301104L.CEO.4: To define the basic aspects and applications of polymers, biomaterials & composites.

2301104L.CEO.5: To illustrate the basic principles, instrumentation & applications of analytical techniques.

2301104L.CEO.6: To outline the technology involved in improving quality of water for its industrial use.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301104L.CO.1: Illustrate natural biological processes and their technical aspects that changed human life by applying engineering principles [L2].

2301104L.CO.2: Explain the impact of chemical bonding on engineering materials and properties [L2].

2301104L.CO.3: Demonstrate proficiency in applying green chemistry principles to engineering solutions [L2].

2301104L.CO.4: Make use of advanced instrumental methods for the analysis of chemical compounds [L3].

2301104L.CO.5: Analyze information from case studies and applications to strategize solutions for complex real-world engineering challenges [L4].

## COURSE ABSTRACT

The fundamental objective of the Science of Nature course is to provide the extended knowledge of chemistry & biology required for engineering courses. The course defines the role of chemistry for engineers via topics like atomic structure & green chemistry principles. A few topics like Formation of Materials which covers chemical bonding and their influence on chemical properties & Engineering materials are included. This enables students to understand the application of chemistry in electronic gadgets, in construction, chemical compounds as a conducting materials, as smart materials, as nano materials viz carbon nano materials etc. Further, the analysis part involves various instrumental methods. It is aimed to give information about the advanced characterization and separation techniques of chemical compounds. The biology part of the course includes phenomena observed in nature viz., Physical, Chemical and Biological along with the case studies and applications. This gives much needed information about natural biological processes and their technical aspects in view of optimizing Engineering solutions. This promotes the applicability of engineering in understanding of chemistry/biology and visa-versa.

| **PRACTICALS:** Any 8 Experiments will be conducted. | | |
|---|---|---|
| **PRACTICAL NO.01** | **Distillation** | **2 HOURS** |
| Separation of two miscible liquids using distillation process. | | |
| **PRACTICAL NO.02** | **Polymerization** | **2 HOURS** |
| Synthesis by condensation polymerization reaction. | | |
| **PRACTICAL NO.03** | **Nano Particle** | **4 HOURS** |
| Synthesis of nano particles using reduction method. | | |
| **PRACTICAL NO.04** | **pH Metry** | **4 HOURS** |
| Determination of the dissociation constant of a weak acid using pH meter. | | |
| **PRACTICAL NO.05** | **Paper Chromatography** | **2 HOURS** |
| Separation of inorganic cations by paper chromatography. | | |
| **PRACTICAL NO.06** | **TLC** | **2 HOURS** |
| Separation of organic compounds by TLC. | | |
| **PRACTICAL NO.07** | **Conductometry** | **4 HOURS** |
| Conductometric titration for mixture of acids. | | |
| **PRACTICAL NO.08** | **Colorimetry / Spectrophotometry** | **2 HOURS** |
| Absorption studies. | | |
| **PRACTICAL NO.09** | **Hardness of Water** | **4 HOURS** |
| Determination of Hardness of water by EDTA method. | | |
| **PRACTICAL NO.10** | **Alkalinity** | **2 HOURS** |
| Determination of alkalinity of water by neutralization titration. | | |
| **PRACTICAL NO.11** | **Adsorption Studies** | **2 HOURS** |
| Water purification by activated charcoal. | | |
| **PRACTICAL NO.12** | **Physical Phenomenon** | **2 HOURS** |
| Case Studies of Physical Phenomenon | | |
| **PRACTICAL NO.13** | **Chemical Phenomenon** | **2 HOURS** |
| Case Studies of Chemical Phenomenon | | |
| **PRACTICAL NO.14** | **Biological Phenomenon** | **2 HOURS** |
| Case Studies of Biological Phenomenon | | |

## TEXT BOOKS


1. Jain, P. C., & Jain, M. (1998). Engineering Chemistry: Chemistry of Engineering Materials. Dhanpat Rai Pub. Com.
2. Khopkar, S. M. (2008). Basic of Concept of Analytical Chemistry; 3 rd Edn; New AGF International Pvt. Ltd. Publisher, New Delhi, 1-5.
3. Chauhan, B. S. (2008). Engineering Chemistry. Laxmi Publications, Ltd..
4. Lodish, H., Berk, A., Kaiser, C. A., Kaiser, C., Krieger, M., Scott, M. P., ... & Matsudaira, P. (2008). Molecular cell biology. Macmillan.


## REFERENCE BOOKS


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3. Willard, H. H., Merritt Jr, L. L., Dean, J. A., & Settle Jr, F. A. (1988). Instrumental methods of analysis.
4. Pradeep, T. (2012). Textbook of nanoscience and nanotechnology. McGraw-Hill Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. 2023 NEP) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Foundation of Computing |
| | **COURSE CODE** | 2304101T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** Basics of Computer and Mathematics

**COURSE OBJECTIVES :**

2304101T.CEO.1: Enhance problem solving abilities of students.
2304101T.CEO.2: Develop a logic to efficiently use the programming constructs to solve the computing problems.
2304101T.CEO.3: Encourage the test driven coding approach.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304101T.CO.1: Design a solution to the problem by applying appropriate logic to get the desired results.[L3]
2304101T.CO.2: Design an algorithm and flowchart for the problem using traditional and tool-based approaches.[L3]
2304101T.CO.3: Solve the real world problems by multiple programming solutions.[L3]

**COURSE ABSTRACT:**

The Course emphasizes logic building and problem-solving abilities to write efficient algorithms and understanding how to debug and test C programs. C is the best programming language to start learning in computer programming. The significance of the C programming language is that it is recognized worldwide and used in many of the applications, including advanced scientific systems and operating systems. The C language provides the base language of all advanced computer languages. Course contains basic elements of C programming,data types, operators, Control Structures, conditional statements, looping , arrays, string operations, functions, pointers,user defined data types-structure and union.

**THEORY COURSE CONTENTS**

| UNIT 1 | FUNDAMENTALS OF C | 04 HOURS |
|---|---|---|

**Applications/Case Study:** Introduction to SCRATCH tool, Gaming applications, calculator application

**Contents:** Introduction to programming, why to learn programming, programming for everybody, Overview of C, Character set, Constants, Variables and Keywords, Data types, Operators - arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operator, Expressions- Type Conversion, precedence and order of evaluation

**Self Study:** Using conditions and loops on SCRATCH

| UNIT 2 | CONTROL STRUCTURES | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Ticket Booking App, online shopping site

**Contents:** Decision Control Structure-If statement, if-else statement, Nested if-else statement, Ternary operator, Case Control structure- Switch Case Statements, GOTO statement, Loop Control Structure-while statement, do while statement, for statement, odd loop, nesting of loops, break and continue statement, finite and infinite Loop

**Self Study:**Prepare Algorithm and Flowchart for the control statements above

| UNIT 3 | ARRAYS, STRINGS, FUNCTIONS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Leader Board of a game, Spell Checkers,Search Engine

**Contents:** Array Declaration and Initialization, Bounds Checking, Array arithmetic, One dimensional arrays and multi-dimensional Arrays, Strings - Standard Library String Functions, Array of strings, String operations, Functions, procedures, Difference between functions and procedures, Function definition and prototype, Scope Rule of Functions, Calling Conventions, Passing Values between Functions - Call by Values, Recursive functions, Passing Array Elements to a Function

**Self Study:** How to pass 2D array as a function parameter, Variable Length Arrays (VLAs) in C

| UNIT 4 | POINTERS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Dynamic Memory Allocation, Implementation of Data Structures

**Contents:** Pointers and Addresses, Pointer Notation and Arithmetic, Pointer to an array, Array of pointers, Pointer to a function, Passing pointers as function arguments, function call by reference, difference between call by value and call by reference, Strings and Pointers, Structures and Pointers

**Self Study:** Pointer to Pointer (Double Pointer), Chain of Pointers in C

| UNIT 5 | USER DEFINED DATA TYPES | 04 HOURS |
|---|---|---|

**Applications/Case Study:** Memory management, Database Management

**Contents:** Structures and Union: Declaration of Structure and Union, Difference between Structure and Union, Accessing Structure Elements, How Structure Elements are Stored, Array of Structures

**Self Study:** Anonymous Union and Structure in C, Enumeration (enum) in C

**Further Readings:** User Defined Data Type- class in CPP

## TEXT BOOKS


1. E. Balguruswamy , "Computing Fundamentals and C Programming" , Tata Mc-Graw Hill, ISBN 13: 978-0-07-066909-3
2. Balagurusamy, E. (2016). Programming In Ansi C.
3. Kanetkar, Y. (2018). Let us C. BPB publications.
4. Yashavant, K. (2020). Let us C. BPB Publications.
5. Kernighan, B. W., & Ritchie, D. M. (2002). The C programming language.
6. GHOSH, S. (2008). All of C. PHI Learning Pvt. Ltd.


## REFERENCE BOOKS


1. Hanly, J. R., & Koffman, E. B. (2007). Problem solving and program design in C. Pearson Education India.
2. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, Oxford University Press, ISBN 13 978-0-19-806528-9
3. S. Thamrai Selvi, R Murugesan, "Test your skills in C", Tata Mcgraw Hill, ISBN13:978-0-07-044759-2
4. Yashvant Kanitkar, "C Projects", BPB Publication, 2nd Edition, ISBN 81-7029-256-5
5. R.G. Dromey , "How to solve it by Computer", Prentice Hall, ISBN -13. 978-0134340012
6. Byron S. Gottfried, Jitender Kumar Chhabra, "Programming with C", Tata Mcgraw Hill, ISBN13:978-0- 07-059369-5


## E-RESOURCES

1. https://nptel.ac.in/courses/106105171
2. https://www.geeksforgeeks.org/c-programming-language/
3. https://www.w3schools.com/c/
4. https://www.codechef.com/ide
5. https://scratch.mit.edu/
6. https://www.youtube.com/@bhagyashreealhat4824/videos

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. 2023 NEP) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Foundations of Computing Lab |
| | **COURSE CODE** | 2304101L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 02 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Basics of Computer and Mathematics

**COURSE OBJECTIVES :**

2304101L.CEO.1: Facilitate the building of programming solutions using the appropriate programming constructs.

2304101L.CEO.2: Encourage logical thinking to find alternate programming solution for the given problem.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304101L.CO.1: Make use of appropriate programming constructs to solve real world problems. [L3]

2304101L.CO.2: Build modular, reusable code using functions, recursions and standard library functions. [L3]

2304101L.CO.3: Build a programming solution with suitable logic to get the required output.[L3]

**COURSE ABSTRACT:**

The Foundation of Computing Lab is a hands-on course designed to complement the theoretical knowledge of C programming with practical experience. This lab course aims to develop a deep understanding of the C language through a series of lab assignments, home assignments and real-world problem-solving scenarios. Students will learn the fundamentals of programming in C, including data types, control structures, functions, arrays, pointers.Emphasis is placed on writing optimized, readable, and error-free code via test driven approach.

**PRACTICALS**

| **PRACTICAL NO.01** | **Fundamentals of C** | **4 HOURS** |
|---|---|---|

**Practice Problem Statements:**

1. * Write a menu driven program in C to display addition, subtraction, multiplication, division of two numbers
2. Write a program in C to display the quotient and remainder after the division of two numbers
3. Write a program to evaluate any mathematical expression and observe the operator precedence
4. Write a program in C to demonstrate the use of left shift, right shift, and, or, xor operators

**Assignment:**

1. Write a program in C to demonstrate logical and relational operators

| **PRACTICAL NO.02** | **Control Structures** | **6 HOURS** |
|---|---|---|

**Practice Problem Statements:**

1. * Write a program in C to display the grade obtained by the student in a course. The input will be the marks obtained and the output will be the grade obtained
2. * Write a program in C to display first N numbers on the screen using while, do while and for loop
3. * Write a program in C to display first N number in reverse order on the screen using while, do while and for loop
4. * Write a program in C display various patterns using * ( Any two Patterns)
5. Get the information of lengths of sides and angles of triangle and print the type of triangle whether it is equilateral, isosceles or scalene, right, acute or obtuse.

**Assignment:**

1. Prepare a grocery bill after applying 5% discount for new customer and 10% discount for regular customer

| PRACTICAL NO.03 | Arrays, Strings and Functions | 8 HOURS |
|---|---|---|

**Practice Problem Statements:**

1. * Write a program in C to perform matrix addition
2. * Write a program in C to implement linear search and binary search algorithms for a numeric array
3. * Write a program in C to convert every lowercase letter to uppercase letter and vice versa
4. * Write a program in C to implement the string functions using the standard library functions supported by string.h like: string length, string copy, string reverse, string concatenate, string compare, sub string
5. Write a program in C to perform matrix multiplication
6. Take three different arrays to store numbers divisible by 2, 3 and 5 respectively. Get 20 numbers as input and place them in appropriate array
7. Write a C function to find simple interest. Pass input values as parameters
8. Write a program in C using recursion to display the Fibonacci sequence for a given range

**Assignment:**

1. Write a menu driven program in C using functions to implement the following string operations without using the standard library functions, string concatenate, string compare, string palindrome

| PRACTICAL NO.04 | Pointers | 8 HOURS |
|---|---|---|

**Practice Problem Statements:**

1. * Write a program to differentiate between pointer to an integer and pointer to an array of integers
2. * Write a program to print addresses of array elements using pointers
3. * Write a C function to swap values of two variables using call by reference
4. * Write a program to store and access string using pointer to string
5. Print numbers within given range by passing the function pointer as a parameter
6. Demonstrate working of circular linked list using pointers

| PRACTICAL NO.05 | User Defined Data Types | 2 HOURS |
|---|---|---|

**Practice Problem Statements:**

1. * Write a program in C to accept the information of five students and store it in structure and display the same
2. Write a C program using structure to store employee data (Name and salary) , then display name of the manager who is having highest salary, and obtain total expenditure of company on employee's salary

**Assignment(Any one):**

1. Use structure and pointers to maintain Olympic game's data. Store the information of medals won by several countries. Depending upon the types of medals won by the respective country give the rank
2. Use structure and pointers to maintain books data. Depending upon the number of readers of a book measure the popularity of that book

| PRACTICAL NO.06 | Competitive Coding | 4 HOURS |
|---|---|---|

* Solve scenario based real world problems by developing a solution in series of steps such as designing algorithms, data structures, coding/programming and testing.
Note: Practice Multiple Problems

**TEXT BOOKS**


1. E. Balguruswamy , "Computing Fundamentals and C Programming" , Tata Mc-Graw Hill, ISBN 13: 978-0-07-066909-3
2. Balagurusamy, E. (2016). Programming In Ansi C.
3. Kanetkar, Y. (2018). Let us C. BPB publications.
4. Yashavant, K. (2020). Let us C. BPB Publications.
5. Kernighan, B. W., & Ritchie, D. M. (2002). The C programming language.
6. GHOSH, S. (2008). All of C. PHI Learning Pvt. Ltd.

## REFERENCE BOOKS


1. Hanly, J. R., & Koffman, E. B. (2007). Problem solving and program design in C. Pearson Education India.
2. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, Oxford University Press, ISBN 13 978-0-19-806528-9
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6. Byron S. Gottfried, Jitender Kumar Chhabra, "Programming with C", Tata Mcgraw Hill, ISBN13:978-0- 07-059369-5


## E-RESOURCES

1. https://nptel.ac.in/courses/106105171
2. https://www.geeksforgeeks.org/c-programming-language/
3. https://www.w3schools.com/c/
4. https://www.codechef.com/ide
5. https://scratch.mit.edu/
6. https://www.youtube.com/@bhagyashreealhat4824/videos

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF CIVIL ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. 2023 (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Applied Mechanics |
| | **COURSE CODE** | 2303101T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2303101T.CEO.1: To define fundamental concepts and laws of rigid body mechanics.
2303101T.CEO.2: To state conditions of equilibrium for engineering structures.
2303101T.CEO.3: To describe kinematic parameters of rectilinear and curvilinear motion.
2303101T.CEO.4: To explain energy and momentum methods of kinetics"

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2303101T.CO.1: Determine the resultant of system of forces acting on bodies. [L1]
2303101T.CO.2: Calculate the support reactions and member forces for simple structures. [L2]
2303101T.CO.3: Analyse bodies in rectilinear and curvilinear motion. [L4]
2303101T.CO.4: Apply energy and momentum methods for kinetics problems. [L3]

## COURSE ABSTRACT

This course is built on the foundation and framework of mathematics and physics. The course requires students to have strong abstract thinking and reasoning skills. In addition, Concepts will be applied in this course from previous courses you have taken in basic math and physics. The course addresses the modeling and analysis of real world engineering applications and problem solving. In this course, we shall be learning about interaction between bodies dealing with STATICS and in the second part DYNAMICS students will study the motion of particles. Statics covers free body diagrams, equilibrium of rigid bodies, analysis of trusses and beams, discussion on friction, virtual work and stability. Dynamics deals with general plane motion of rigid bodies, use of translating and rotating motion frames of reference for analysis, plane kinetics and work energy principle.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Basics of Statics** | **7 HOURS** |

**Applications/Case Study:** Failure of any building, bridge etc.

**Contents:** Fundamental Concepts and Principles in mechanics, Force and force systems, Resolution, Resultant, and Moment of a force system; Equilibrium of a particle systems. Free body diagram (FBD). Equilibrium of rigid bodies.

**Self Study:** Observe the static objects around you and draw free body diagram and calculate resultant of same.

| | | |
|---|---|---|
| **UNIT 2** | **Applications of Statics** | **8 HOURS** |

**Applications/Case Study:** Determination of axial forces for industrial truss.

**Contents:** Types of supports and their reactions. Beam reactions, Analysis of cables, Analysis of trusses, and Analysis of frames. Centroid of plane laminas. Engineering applications of friction. Belt Friction, Wedge friction.

**Self Study:** Understanding following questions are expected from the students.

1. What does it mean for a design of members to be ”Statically indeterminable”?
2. What is a ”Two force Member”?
3. Which forces are allowed on a member?

| | | |
|---|---|---|
| **UNIT 3** | **Kinematics of particle** | **8 HOURS** |

**Applications/Case Study:** Falling Body and Projectile Motion Case Study.

**Contents:** Basic concepts in kinematics- Position, velocity, acceleration, jerk. Rectilinear motion with constant and variable acceleration. Connected body motions. Relative motion. Curvilinear motion in Cartesian coordinates and path coordinates.

**Self Study:** Study of gyroscopic motion.

| UNIT 4 | Kinetics of particle | 7 HOURS |
|---|---|---|

**Contents:** Kinetics- Equation of motion. Concept of work done, energy and power. Principle of work and energy. Conservation of energy. Principle of impulse and momentum. Conservation of momentum. Collisions- Direct central impact. Coefficient of restitution.

**Self Study:** Study of vehicle dynamics.

## TEXT BOOKS


1. Nelason, A. (2009). Engineering Mechanics: Statics and Dynamics. 2nd Edition, Tata McGraw-Hill Education.
2. Anil Kumar D. (2015). Engineering Mechanics: Statics Dynamics", 1st edition, Tata McGraw-Hill Education.


## REFERENCE BOOKS


1. Hibbeler, R. C. (2009). Gupta Ashok Engineering Mechanics: Statics Dynamics.", 14th Edition, Pearson Education Inc., Prentice Hall.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF CIVIL ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. 2023 (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Applied Mechanics Lab |
| | **COURSE CODE** | 2303101L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2303101L.CEO.1: To provide students with hands-on experience and practical knowledge in the field of applied mechanics.

2303101L.CEO.2: To bridge the gap between theoretical concepts learned in the classroom and real-world applications.

2303101L.CEO.3: To develop a deep understanding of fundamental mechanics principles and their practical implications.through a combination of experiments and projects,"

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2303101L.CO.1: Develop a practical understanding of fundamental mechanics principles and apply theoretical knowledge to solve real-world engineering problems [L3].

2303101L.CO.2: Analyze, and interpret experimental data, and present results in a clear and organized manner [L4].

2303101L.CO.3: Design, conduct, and analyze experiments by effective collbrating with team members [L6].

2303101L.CO.4: Build ethical behavior in conducting experiments, handling data, and interacting with colleagues [L3]. "

## COURSE ABSTRACT

The Applied Mechanics Laboratory serves as a crucial platform for understanding fundamental principles and practical applications of mechanics in engineering. This abstract provides an overview of the objectives, methodologies, and potential outcomes of experiments conducted within this laboratory setting.The primary goal of the Applied Mechanics Laboratory is to provide students with hands-on experience in exploring and analyzing various mechanical phenomena. Through a series of carefully designed experiments, participants gain insights into the behavior of materials and structures under different loading conditions. The laboratory covers a diverse range of topics, including statics and dynamics.Experiments within the laboratory involve the use of state-of-the-art equipment and measurement tools to investigate the mechanical characteristics of materials such as metals, polymers, and composites. Static experiments focus on equilibrium conditions and the study of forces and moments, while dynamic experiments explore the dynamic response of structures to external forces.

## PRACTICALS/ACTIVITIES

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Parallelogram Law** | **2 HOURS** |
| To verify parallelogram law of force addition. | | |
| **PRACTICAL NO.02** | **Law of moments** | **2 HOURS** |
| To verify law of moments for parallel forces. | | |
| **PRACTICAL NO.03** | **Block Friction** | **2 HOURS** |
| To determine coefficient of static friction for a block on a plane. | | |
| **ACTIVITY NO.01** | **Truss model** | **2 HOURS** |
| To develop truss model. | | |
| **PRACTICAL NO.04** | **Belt Friction** | **2 HOURS** |
| To determine coefficient of static friction for a flat belt on a drum. | | |
| **PRACTICAL NO.05** | **Centroid 1D** | **2 HOURS** |
| To determine centroid of composite wire object. | | |
| **PRACTICAL NO.06** | **Centroid 2D** | **2 HOURS** |
| To determine centroid of composite plane lamina. | | |
| **ACTIVITY NO.02** | **Model making for Centroid** | **2 HOURS** |
| To develop the model for centroid. | | |
| **PRACTICAL NO.07** | **Projectile Motion** | **2 HOURS** |
| To analyze projectile motion in Cartesian coordinates. | | |
| **ACTIVITY NO.03** | **Model making for Projectile** | **2 HOURS** |
| To develop the model for projectile. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.08** | **Compound Pendulum** | **2 HOURS** |
| To determine mass moment of Inertia of compound pendulum. | | |
| **PRACTICAL NO.09** | **Fly Wheel** | **2 HOURS** |
| To analyse rotational motion of a flywheel about a fixed axis. | | |
| **ACTIVITY NO.04** | **Model of parachute** | **2 HOURS** |
| To develop the parachute model. | | |
| **PRACTICAL NO.10** | **Direct Central Impact** | **2 HOURS** |
| To determine coefficient of restitution for direct central impact. | | |
| **PRACTICAL NO.11** | **Final Exam** | **2 HOURS** |
| For all batches during the lab hours. | | |

**TEXT BOOKS**

1. Meriam, J. L., Kraige, L. G., & Bolton, J. N. (2020). Engineering mechanics: dynamics. John Wiley & Sons.

**REFERENCE BOOKS**

1. NIL

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF MECHANICAL ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev.2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Design Thinking |
| | COURSE CODE | 2309101T |
| | COURSE CREDITS | 1 |
| RELEASED DATE : -- | REVISION NO | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2309101T.CEO.1: To utilize information collection tools to clearly define user centric problem.

2309101T.CEO.2: To apply SCAMPER tool to find diverse solutions.

2309101T.CEO.3: To choose one concept out of the selected alternatives by taking into consideration user centred design parameters.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2309101T.CO.1: Apply information gathering techniques to select user centric problem [L3].

2309101T.CO.2: Apply SCAMPER tool to find diverse solutions [L3].

2309101T.CO.3: Choose one concept out of the selected alternatives by taking into consideration user centred design parameters [L3].

## COURSE ABSTRACT

Design thinking is a powerful process of problem solving as it deals with human centred design approach. When design thinking approaches are applied to business, the success rate for innovation improves substantially. The course aim to imbibe understanding of the design thinking process and apply it to real-world problems while building their strong teamwork and communication skills. Students will learn to use the design thinking process to solve complex problems and create innovative solutions. Course covers topics such as research, ideation, prototyping, testing, and iteration. Students also learn to use a variety of design thinking tools, such as personas, journey maps, mind mapping, SWOT analysis, SCAMPER, Brainstorming, AEIOU framework etc. Students work in team to tackle real-world design challenges. So they learn how to communicate their ideas effectively and how to receive and give constructive feedback and present their design solutions in aclear and compelling manner. Upon completion of the course, students will have a deep understanding of the design thinking process and how to apply it to real-world problems. They will be able to use a variety of design thinking tools and techniques to generate and evaluate ideas, create prototypes, and test and refine their solutions. They will also have strong teamwork and communication skills, making them valuable members of any design team.

## THEORY COURSE CONTENTS

| UNIT 1 | FUNDAMENTALS OF DESIGN THINKING | 2 HOURS |
|---|---|---|

Introduction to design, types of design, Introduction to Design Thinking, Divergent Thinking, Convergent Thinking.

Various types of thinking: Critical thinking, Creative thinking, lateral thinking, Disruptive Thinking.

**Self Study:** Timeline.

| UNIT 2 | HUMAN CENTRED DESIGN | 2 HOURS |
|---|---|---|

Introduction to Human Centred Design, Human Centred Design Phases, Human Centred Design Process, Human Centred Design case study, Planet centric Design.

**Self Study:** Customer Journey Map.

| UNIT 3 | ANTHROPOLOGY | 2 HOURS |
|---|---|---|

Characteristics of Anthropology: Culture, holistic approach, field work, multiple theories and purposes of anthropology. Empathy and Ethnography.

**Self Study-** Ethnograpy: AEIOU Framework.

| UNIT 4 | RESEARCH METHODOLOGY | 3 HOURS |
|---|---|---|

Design thinking Models & Methodology, General Problem Statement, Random check list, mind mapping, Categorization of random check list, Brainstorming of problem areas Research Methodology – Information gathering – Primary, Secondary Sources, data presentation, Preparation of survey forms, Survey Analysis, Drawing Inference.

**Self Study:** Likert Scale, Affinity Diagram, Reverse engineering of a research paper to identify all the essential elements of the research.

| UNIT 5 | IDEATION | 4 HOURS |
|---|---|---|
| SWOT analysis, Vein Diagram (User Desirability, Feasibility, Viability check) Drawing inferences, Translation of inferences into design criteria, specific problem statement, Ideation – free hand sketching drawing of simple form of products (Isometric views, layout, circuit diagram, Ideation sketches), Ergonomic and aesthetic consideration in design.<br>**Case Study:** SCAMPER, TRIZ. | | |
| **UNIT 6** | **PROTOTYPING** | **2 HOURS** |
| Concept validation, evaluation and detailing, Different methods of Prototyping, selection of right method of prototyping.<br>**Case Study:** Minimum Viable Product. | | |

## TEXT BOOKS


1. Yayici, E. (2016). Design thinking methodology book. ArtBizTech.
2. Mootee, I. (2013). Design thinking for strategic innovation: What they can't teach you at business or design school. John Wiley & Sons.
3. Lockwood, T. (2010). Design thinking: Integrating innovation, customer experience, and brand value. Simon and Schuster.
4. Marc, S. (2012). This is Service Design Thinking: Basics-Tools-Cases. Bis Publishers.


## REFERENCE BOOKS


1. Jones, J. C. (1992). Design methods. John Wiley & Sons.
2. Cross, N. (2011). Design thinking: Understanding how designers think and work. Berg.
3. Gonen, E. (2020). Tim brown, change by design: how design thinking transforms organizations and inspires innovation (2009). Markets, Globalization & Development Review, 4(2).
4. Melles, G., de Vere, I., & Misic, V. (2011). Socially responsible design: thinking beyond the triple bottom line to socially responsive and sustainable product design. CoDesign, 7(3-4), 143-154.
5. Kumar, V. (2012). 101 design methods: A structured approach for driving innovation in your organization. John Wiley & Sons.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF MECHANICAL ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev.2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Design Thinking Lab |
| | COURSE CODE | 2309101L |
| | COURSE CREDITS | 1 |
| RELEASED DATE : -- | REVISION NO | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 20 | 40 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2309101L.CEO.1: To apply ethnographic framework to carryout design thinking project.
2309101L.CEO.2: To build prototype of alternative based on human centred design.
2309101L.CEO.3: To present design thinking project.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2309101L.CO.1: Apply ethnographic framework to carryout design thinking project [L3].
2309101L.CO.2: Evaluate most appropriate solution for defined user centric problem [L6].
2309101L.CO.3: Build the prototype of the most optimum solution [L3].

**COURSE ABSTRACT**

In Design thinking lab students will carry out all the steps involved in design thinking practically. The steps involved are empathy, problem definition, ideation, prototyping and testing. Students will engage in observing and understanding user needs within a specific domain. They will carry out primary and secondary research to gather relevant data and insights (empathy map and problem definition). This research will help students to define the specifications and requirements for the product. Using SCAMPER tool students will generate innovative ideas based on the identified needs and specifications (ideation). Evaluation of concepts will be carried out by using Pugh matrix and the concept which is having more weightage will be selected for creating a prototype (concept evaluation and testing). Using this prototype student will validate the solution by taking feedback from user(testing). In summary student will apply the tools taught during theory class to carry out their design thinking project.

| **PRACTICALS:(Project Work)** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Needs Finding (Observation of Domain)<br>**Self Study:** space Interaction. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Research methodology | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Product Specification<br>**Self Study:** RUTAG Project Exploration. | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Ideation | | |
| **PRACTICAL NO.05** | | **4 HOURS** |
| Concept Evaluation, Validation and Concept detailing<br>**Self Study:** Pugh Matrix. | | |
| **PRACTICAL NO.06** | | **6 HOURS** |
| Prototyping | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Documentation | | |

## TEXT BOOKS


1. Yayici, E. (2016). Design thinking methodology book. ArtBizTech.
2. Mootee, I. (2013). Design thinking for strategic innovation: What they can't teach you at business or design school. John Wiley & Sons.
3. Lockwood, T. (2010). Design thinking: Integrating innovation, customer experience, and brand value. Simon and Schuster.
4. Marc, S. (2012). This is Service Design Thinking: Basics-Tools-Cases. Bis Publishers.


## REFERENCE BOOKS


1. Jones, J. C. (1992). Design methods. John Wiley & Sons.
2. Cross, N. (2011). Design thinking: Understanding how designers think and work. Berg.
3. Gonen, E. (2020). Tim brown, change by design: how design thinking transforms organizations and inspires innovation (2009). Markets, Globalization & Development Review, 4(2).
4. Melles, G., de Vere, I., & Misic, V. (2011). Socially responsible design: thinking beyond the triple bottom line to socially responsive and sustainable product design. CoDesign, 7(3-4), 143-154.
5. Kumar, V. (2012). 101 design methods: A structured approach for driving innovation in your organization. John Wiley & Sons.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. 2023 (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Electronics Workshop |
| | **COURSE CODE** | 2307161T |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | PRACTICAL | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307161T.CEO.1: Identify the appropriate electronic component for specific requirements
2307161T.CEO.2: Handle testing and measuring instruments.
2307161T.CEO.3: Get conversant with process of Printed Circuit Board design and fabrication.
2307161T.CEO.4: Make aware of Surface Mounted Technology.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307161T.CO.1: Illustrate the functionality of different types of electronics components, interpretation of their data sheets, measuring instruments, Through Hole Technology, Surface - Mount Technology, Printed Circuit Board and Soldering methods to solve engineering problems.[L2]
2307161T.CO.2: Identify the faults and safety guidelines for electronic instruments.[L3]

## COURSE ABSTRACT

The course is structured to provide a balanced blend of theoretical concepts and hands-on practical training to the students and enabling them to confidently delve into the diverse world of electronic components, gaining insight into their characteristics, behaviors, and compatibility. This course also develops the skill to handle and interpret measurements obtained from different electronic measuring instruments. It is a comprehensive course designed to equip students with the skills and knowledge required to design and fabricate Printed Circuit Board (PCB) by following safety practices to meet standards and design specifications required to develop a prototype. In addition with PCB fabrication, the students get acquainted with a comprehensive understanding of Surface Mount Technology (SMT) principles, processes, and applications.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Electronic Components** | **04 HOURS** |

**Contents:** Functionality and types of electronic components - Active, Passive, Electrical, Electronic, Electro-mechanical. IC packages (Single in-line, Zigzag in-line etc.) Drawing of electronic circuit diagrams using BIS/IEEE symbols. Selection of Components as per requirement of any specific application. .

**Self Case-Study:** Comparative analysis of applications of different electronics components.

| | | |
|---|---|---|
| **UNIT 2** | **Testing and Measuring Instruments** | **05 HOURS** |

**Contents:** Functionality diagram, working and use of Testing and Measuring instruments and tools: Digital Multimeter, True RMS meter, Function generator, LCR Meter, Power supply, CRO, DSO, Analog & Digital IC Tester etc. Inter-connection methods and soldering practice: Bread board, Wrapping, Crimping, Soldering types selection of materials and safety precautions. Fault finding case-study of any electronic instrument.

**Self Study:** DOs and DONTs Safety guidelines while handling electronics instruments.

| | | |
|---|---|---|
| **UNIT 3** | **PCB Design and Fabrication** | **04 HOURS** |

**Contents:** Printed circuit boards (PCB): Types, Single sided, Double sided, PTH. Process of PCB Design and Fabrication for any electronic circuit..

**Case Study:** Industrial application of PCB design and fabrication.

| | | |
|---|---|---|
| **UNIT 4** | **Surface-Mount Technology** | **02 HOURS** |

**Contents:** Introduction, Surface-mount vs Through-Hole, Types, advantages, disadvantages and application of SMT.

**Self Case-Study:** Pick and Place machine.

## TEXT BOOKS

1. J C Whitakar, (2005), *The Electronics Handbook*, 2nd edition, CRC press, ISBN 9780367250010
2. Walter C. Bosshart,(1983), *Printed Circuit Boards: Design and Technology*. Tata McGraw-Hill Education, ISBN: 978-0074515495.
3. H.S.Kalsi, (2019), *Electronic Instruments and Measurements*, McGraw Hill Education, 4th Edition, ISBN: 978-9353162511.

## REFERENCE BOOKS


1. Horowitz Paul, (2018), *Art of Electronics*, 3rd edition,Cambridge University Press, ISBN: 9780521809269
2. Raghunandan G H, (2019), *Basic Electronics: A Simplified Approach*, Cengage Learning India Pvt. Ltd.
3. Purkait Prithwiraj, (2013). *Electrical and Electronics Measurement and Instrumentation*, 1st edition, McGraw-Hill Education, ISBN-13: 978-1259029592


## e-Content Links

1. https://be-iitkgp.vlabs.ac.in/exp/familiarisation-resistor
2. https://be-iitkgp.vlabs.ac.in/exp/familiarisation-capacitor
3. https://be-iitkgp.vlabs.ac.in/exp/familiarisation-inductor
4. https://he-coep.vlabs.ac.in/exp/monostable-astable-oscillator
5. https://fab-coep.vlabs.ac.in/exp/pcb-design-fabrication
6. http://vlabs.iitkgp.ac.in/be
7. http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAE/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev. 2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Electronics Workshop Lab |
| | COURSE CODE | 2307161L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO. | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | PRACTICAL | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 20 | 40 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307161L.CEO.1: Introduce the identification and testing of electronic components to be selected for a particular electronic circuits, and the interpretation of their data sheets.

2307161L.CEO.2: Make use of testing and measuring electronic instruments.

2307161L.CEO.3: Demonstrate the use of a simulation tool for an electronic circuit and its implementation on breadboard.

2307161L.CEO.4: Impart the knowledge of PCB fabrication process and Surface-Mount Technology.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307161L.CO.1: Demonstrate fundamental skills using modern engineering tools for the simulation of electronic circuits considering the specifications of the components.[L3]

2307161L.CO.2: Develop a solution in a team for engineering problems on the breadboard considering the safety guidelines.[L4]

2307161L.CO.3: Build a Printed Circuit Board in a team using modern tools for an electronic project and communicate it through effective presentation and demonstration.[L4]

## COURSE ABSTRACT

The course is structured to provide a balanced blend of theoretical concepts and hands-on practical training to the students and enabling them to confidently delve into the diverse world of electronic components, gaining insight into their characteristics, behaviors, and compatibility. This course also develops the skill to handle and interpret measurements obtained from different electronic measuring instruments. It is a comprehensive course designed to equip students with the skills and knowledge required to design and fabricate Printed Circuit Board (PCB) by following safety practices to meet standards and design specifications required to develop a prototype. In addition with PCB fabrication, the students get acquainted with a comprehensive understanding of Surface Mount Technology (SMT) principles, processes, and applications.

## PRACTICALS

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Identification of Electronic Components** | **2 HOURS** |
| Identification of following electronic components with specifications - type, size, color coding, package, symbol, cost, ratings etc. Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Displays, Fasteners, Heat sink etc. | | |
| **PRACTICAL NO.02** | **Drawing the electronic circuit with standard symbols.** | **2 HOURS** |
| Introduction to EDA tools to draw the electronic circuit with standard symbols. (such as Dia or XCircuit) | | |
| **PRACTICAL NO.03** | **Interpretation of Data sheets and simulation** | **2 HOURS** |
| Interpret data sheets of discrete components and ICs, Estimation and costing, Introduction to the Simulation Tool to simulate electronic circuit. | | |
| **PROJ. ACTIVITY 1** | **Simulation of electronic circuit** | |
| Simulation of simple circuits using electronic components (inclusive of minimum one DIP IC). | | |
| **PRACTICAL NO.04** | **Testing of electronic components** | **2 HOURS** |
| Testing of electronic components: Resistor, Capacitor, LED, Diode, Transistor and JFET using Digital Multimeter. | | |
| **PRACTICAL NO.05** | **Hands-on with Testing and Measuring instruments and Tools** | **4 HOURS** |
| Hands-on with Testing and Measuring instruments and commonly used tools: Digital Multimeter, True RMS meter, Function generator, LCR Meter, Power supply, CRO, DSO, Analog & Digital IC Tester, Soldering iron, Desoldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Hot air soldering and de- soldering station etc. | | |
| **PRACTICAL NO.06** | **Open-it and Explore** | **2 HOURS** |
| Exploration of the inside view of circuitry of electronic equipment. | | |

| PROJ. ACTIVITY 2 | Implementation on Bread Board and analysis using instruments. | |
|---|---|---|
| Analysis of input and output waveforms of any circuit using appropriate measuring instrument. | | |
| **PRACTICAL NO.07** | **PCB Layout** | **2 HOURS** |
| PCB layout design with EDA Tools. | | |
| **PRACTICAL NO.08** | **Design and fabrication of a single sided PCB** | **4 HOURS** |
| Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride), drilling and mounting. | | |
| **PROJ. ACTIVITY 3** | **PCB Design and Fabrication** | **2 HOURS** |
| Assembling of electronic circuit/system on single sided PCB, test and show the functioning of any circuit | | |
| **PRACTICAL NO.09** | **Surface Mounted Devices** | **2 HOURS** |
| Assembly of Surface-mounted Devices (SMD). | | |

## TEXT BOOKS


1. J C Whitakar, (2005), *The Electronics Handbook*, 2nd edition, CRC press, ISBN 9780367250010
2. Walter C. Bosshart,(1983), *Printed Circuit Boards: Design and Technology*. Tata McGraw-Hill Education, ISBN: 978-0074515495.
3. H.S.Kalsi, (2019), *Electronic Instruments and Measurements*, McGraw Hill Education, 4th Edition, ISBN: 978-9353162511.


## REFERENCE BOOKS


1. Horowitz Paul, (2018), *Art of Electronics*, 3rd edition,Cambridge University Press, ISBN: 9780521809269
2. Raghunandan G H, (2019), *Basic Electronics: A Simplified Approach*, Cengage Learning India Pvt. Ltd.
3. Purkait Prithwiraj, (2013). *Electrical and Electronics Measurement and Instrumentation*, 1st edition, McGraw-Hill Education, ISBN-13: 978-1259029592


## e-Content Links

1. https://be-iitkgp.vlabs.ac.in/exp/familiarisation-resistor
2. https://be-iitkgp.vlabs.ac.in/exp/familiarisation-capacitor
3. https://be-iitkgp.vlabs.ac.in/exp/familiarisation-inductor
4. https://he-coep.vlabs.ac.in/exp/monostable-astable-oscillator
5. https://fab-coep.vlabs.ac.in/exp/pcb-design-fabrication
6. http://vlabs.iitkgp.ac.in/be
7. http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAE/

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: 2026 - 2027 (Rev. 2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Liberal Learning |
| | COURSE CODE | 2301182L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**COURSE OBJECTIVES :**

2301182L.CEO.1: Create a comprehensive understanding of diverse forms of expression that contribute to liberal education

2301182L.CEO.2: Create a broad set of skills and perspectives for overall development and personal well being.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301182L.CO.1: Develop proficiency in expressive arts, amateur interest for holistic development as a lifelong learning [L6].

2301182L.CO.2: Teach personal and social well-being through mind-body practices for the cultivation of free human beings [L3].

## COURSE ABSTRACT

Liberal education is a learning approach that teaches students how to think independently and develop broad academic and intellectual abilities. It rests on a multidisciplinary and interdisciplinary approach. Education Policy, which had a revamp in 2020 has laid out a path for universities to adopt a liberal education, discussion based and discovery base mode of education. It encourages a multidisciplinary education system that helps develop the creative and analytical sides of the brain simultaneously. It inculcates transferable skill set, ability to apply knowledge to practical real-world situations, connecting the dots through various mental models, habits of self-reflection, contextual learning, freedom of the mind and lifelong learning. India needs a liberal education because to enhance Interdisciplinary and multidisciplinary approach to learning and Preparing students to become real-world person.

**THEORY COURSE CONTENTS: Students may select any one of the following tracks.**

| | | |
|---|---|---|
| **Track 1** | **Chess** | **30 HOURS** |

Introduction to game of Chess. Rules, movement of pieces, strengths and weaknesses of all pieces. Stalemate, touch move, etiquette, pawn promotion and zugzwang, square of the pawn. Fundamental checkmate patterns, basic rules, special moves and rules such as castling, promotion, EnPassant, good moves for the opening.

| | | |
|---|---|---|
| **Track 2** | **Kabaddi** | **30 HOURS** |

Recent trends in kabaddi - History and Development. a) Different forms played - Zemini, Sanjeevani & Amar. b) Different chants (cant) - Hadu-Du, Chedu-Gudu, Hu-tutu & other forms. c) Played in different size playfields with different number of players. d) No uniform rules and regulations, Traditional Kabaddi, Modern Kabaddi. Kabaddi Pioneers: Raiders, Escaping tactics by raiders in different situation, Before starting of the raid strategies, during the raid strategy and tactics, Turning, Falling and sliding as tactics, Creating gap to escape .

| | | |
|---|---|---|
| **Track 3** | **Drama** | **30 HOURS** |

Introduction to Acting, Introduction to Theatre Techniques and Design Theatre History, Literature and Aesthetics, basics of Acting, Theatre Techniques and Design, and Theatre History, Literature and Aesthetics. In the second semester the same subjects are studied in details. Specialisation in Acting, Theatre Techniques and Design Theatre History, Literature and Aesthetic. Theatre History, Literature and Aesthetics, Acting (specialisation).

| | | |
|---|---|---|
| **Track 4** | **Singing** | **30 HOURS** |

Vocal cords, Voice types, Female: Soprano or alto, Male: Tenor, baritone or bass, Breathing Techniques, Role of breathing in singing, types of scales and pitches, Musical notes foundation of any song, Humming exercise, tongue twisters, vowels, Tempo of song, Tempo Markings, Practicing all octaves, analysis of songs, practicing songs.

| Track 5 | Dance | 30 HOURS |
|---|---|---|
| History, mythological aspects, and their impact on the dance form, movements, pattern of beats, use of these forms, Basic knowledge of: basic Adavu steps, hand gestures 'Mudra', Nritta, nrittya and Natakas, Tala, Gati, postures, moods, feet movements, and stances. Introduction to Bollywood dance, Basic Bollywood combinations/choreography, Introduction of styles of Bollywood, Introduction of dance choreographies from classic and modern Bollywood films, influence and inclusion of western dance. History of street dance steps and styles and the pioneers and dance legends involved in their creation, Basic steps of Hip Hop dance, Learn foundations & routines within hip hop culture, Types of hip hop: contemporary hip hop, lyrical hip hop, etc. Dance history, Learning about warm ups, floor work, standing work, travelling work, articulation of limbs, turns and jumps etc. | | |
| **Track 6** | **Painting (Design)** | **30 HOURS** |
| Object Drawing / Still Life - Graphic sketching, mutual proportion of object groups, space joiner, shadow differentiation on objects, Sketching and painting of object groups Memory Drawing - observation, memory and imagination, proportional sketching of incidents in daily life, closeness and distantness (perspective) in drawing. Design – creative expression, basic principles of design, effective use of colors and color shades, aesthetic sense and creation of utility through design, geometrical equipment and material, color mediums and techniques. Geometry, Solid Geometry and Lettering - Development of capability of use of geometrical constructions for creation of pattern, geometrical shapes and their construction. | | |
| **Track 7** | **Sculpture Design** | **30 HOURS** |
| The fundamental principles and techniques of sculpture, including the exploration of various materials and processes, sculptural skills and conceptual thinking. Introduction to sculpture, Brief history of sculpture, tools handling and techniques, material handling techniques, methods & applications – additive & subtractive, pinching method & slab method (application), concepts Development - perceive line as an edge, understanding fundamental elements & principles of sculpture tools handling and techniques, concept understanding. | | |
| **Track 8** | **Introduction to photography** | **30 HOURS** |
| Types of Lights, effect of Lights, Types of Lenses & their uses. Understanding the three main ingredients or elements or pillars of photography that work together: Aperture, Shutter Speed, and ISO. Understanding the concept of ISO sensitivity, in detail with hands-on session. Understanding the concept of Shutter Speed, effect of high & low shutter speed on photographs, with hands-on session. Concept of aperture, F-stop notations, effect of variation of aperture on images. Hands-on session. Compositional Rules like Rule of Thirds, Negative Space, Horizon Line, Golden ratio etc. Framing. Hands-on training. Difference between Auto focus & manual focus, Focusing the object manually, concept of depth of field with wide aperture lens. Hands-on. Framing in landscape photography, bird photography framing. Bokhe effect, Time lapse, multiple exposure, Silhouettes, Long exposure, Steel wool photography. | | |

| Track 9 | Yoga and Meditation | 30 HOURS |
|---|---|---|
| Brief history and philosophy of Yoga, benefits of Yoga, Key techniques of Yoga. Introduction to different types of Yoga, understanding the diversity of yoga practices and their origins, Yoga-Sutras, Limbs of Yoga. Introduction to Meditation, understanding the essence and benefits of meditation, introduction to different types and approaches to meditation, Meditation techniques for health promotion, Relaxation techniques. Overview of Postural alignment, importance of postures, Practices of various posture. Understanding the importance of a balanced diet for overall well-being, Principles of balanced nutrition, diet for preventive and curative aspects of health, Mind Power. Gentle warm-up and stretching, Introduction to seated forward bends and gentle backbends, Relaxation techniques: Guided progressive muscle relaxation. Introduction to breathing and its significance, understanding the role of breathing in overall well-being, importance of conscious breathing in stress reduction and relaxation. Yogic breathings techniques. Intended to various Asana, benefits of Asana. Introduction to pranayama, pranayama techniques for health promotion practical sessions, difference between pranayama and deep breathing, Anuloma-viloma, Suryabhedana, Ujjayi, Bharmari, Bhastrika, Shitali and Shitkari Pranayama. Understanding of Mudras and Kriyas, Practical sessions . | | |
| **Track 10** | **Spiritual Minds** | **30 HOURS** |
| 1.Spirituality -True meaning of Spirituality and explaining the hierarchy of Inner world, awareness about Existence of God.2.Yoga & Meditation- Explaining the Chakras and the Aura, various types of Mediations.3.Respect, Gratitude & Reverence -Explaining the meaning Respect, Gratitude & Reverence by giving the examples from Mahabharata and try to cultivate these qualities in the students.4.Low of Forgiveness and Low of KARMA-Explaining the deepest meaning of Law of forgiveness and Law of KARMA and make the student refrain from unwholesome actions and behaviors.5.Relationship- how to maintain and improve the relationship with Parents, friends, people around us and NATURE.6.Physical and Mental Health – how to improve Physical and Mental health with the help of circadian rhythm, mediation, Pranayamas and yogasanas. How to become more productive.7.Stress Management- discuss the root cause of stress, types of Stress. Explain the techniques and remedies to overcome the Stress.8.Love Yourself – How to give quality time to 'yourself', how to make yourself anxiety free and find the real happiness within us.9.Let's Label jars and not people- how to refrain from to criticism and judgmental with the people around us.10.Goal setting- how to set goals in your life and how to achieve those goals in a positive manner. | | |
| **Track 11** | **Content Writing** | **30 HOURS** |
| Introduction to Content Writing, Writing Fundamentals, Research skills, Blog Writing, Website Writing, Role of SEO in Content Writing, Content Marketing Strategy, Portfolio Development & Career Opportunities, Branding (in copywriting point of view), Technical writing, UX/UI writing, AI in content writing (ChatGPT). | | |

| Track 12 | Digital Marketing | 30 HOURS |
|---|---|---|
| Basics digital marketing, analysis and keyword research, search engine optimization, on-page optimization, off-page optimization, SEO updates and analysis, local business and google mapping, google adwords or pay per click marketing (SEM), social media optimization, social media marketing, google web analytics, webmaster tools, creating a new simple website. Illustrating the dialog delivery, expressions, volume, pitch in the dialog, Expression through photography and editing skill with an expertise in handling cameras, microphone, effective management skill enabling the justification through foundation till representation. | | |
| **Track 13** | **Social Work** | **30 HOURS** |
| Importance of Empathy, Empathy and it's limits, Role of empathy and compassion for engineers, Empathy activities, Differences, Conservatives and Liberals, Disgust and Honor, Stereotypes, The Problem of Kindness, Skepticism About the Self, Free Will and the Situation, Recognizing emotions, reading body language, improving listening skills, mindful self-compassion, Compassionate Leadership, Origins of Morality, joy of giving, social responsibility, exercising social services. | | |
| **Track 14** | **Indian Food Wisdom** | **30 HOURS** |
| History - Introduction, Food consumed in different regions of India, Eating styles of India, Traditional equipment's used for cooking, changes in consumption of foods, Future of traditional foods, Advantages, types, health benefits of Indian food, Millets – Importance of millets in diet, millet as a medicine etc. | | |

**NOTE :** More tracks can be added as per demand of the students and feasibility.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev. 2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Indian Knowledge Systems: Vedic Mathematics |
| | COURSE CODE | 2307181T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 25 | NIL | 50 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307181T.CEO.1: To facilitate the students with the concepts of Indian traditional knowledge
2307181T.CEO.2: To make them understand the Importance of roots of knowledge system.
2307181T.CEO.3: To encourage students to think creatively and critically about mathematical concepts
2307181T.CEO.4: To bring forward the extraordinary work done by Indian Mathematicians in the fields such as Astronomy, Astrology, Geometry, Algebra, and Arithmetic etc.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307181T.CO.1: Explain the history and broad classification of Indian knowledge System [L2].
2307181T.CO.2: Outline the features of Indian numeral system and its role in science technology advancement [L2].
2307181T.CO.3: Apply key Vedic Mathematics principles by understanding foundational concepts and providing clear insights into the underlying principles and relationships [L3].
2307181T.CO.4: Choose suitable Vedic mathematics approaches in solving specific types of problems [L3].

**COURSE ABSTRACT:**

This course will help learners to know and understand their own systems and traditions which are imperative for any real development and progress. Because of this course learners will think independently and originally with Indian frameworks and models for solving the problems of present day.

Vedic Mathematics will not have direct application in Electronics or E&TC Engineering as a specialized field, however it offers benefits and insights that are relevant in certain context.

It will be used in logic development, signal processing, data analysis and designing of algorithms. Recognizing patterns in numbers and exploiting these patterns to simplify calculation is one of the skill in Vedic Mathematics. This skill can be valuable in dealing with complex wave forms, data patterns, image and signal processing.

Deeper concepts like Fibonnaci series, Linear Algebra, Re-configurable Programming in VLSI, problem solving skills can be considered as applications of Vedic Mathematics in Electronics and E&TC discipline.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Indian Knowledge System – An Introduction** | **04 HOURS** |

**Applications/Case Study:** Connections between different fields of study and an affection for traditional knowledge

**Contents:** Introduction and need of IKS; historic importance of IKS; Why do we need IKS; Organization of IKS; Historicity of IKS; Some salient aspects of IKS

**Further Readings/Self Study:** Linkage of Mathematics and IKS

| | | |
|---|---|---|
| **UNIT 2** | **Introduction to Indian Mathematics** | **02 HOURS** |

**Applications/Case Study:** Mathematical Innovations in $17^{th}$ and $18^{th}$ Century

**Contents:** Introduction to Indian Mathematics; Unique aspects of Indian Mathematics; Indian Mathematicians and their Contributions

**Further Readings/Self Study:** Impact of Mathematical Innovations on society

| | | |
|---|---|---|
| **UNIT 3** | **Deep Insights in to Indian Mathematics** | **12 HOURS** |

**Applications/Case Study:** Basic Sutras and subsutras in Vedic Mathematics

**Contents:** Arithmetic; Algebra; Geometry; Trigonometry; Binary mathematics and combinational problems in Chandaḥ Śāstra; Magic squares in India

**Further Readings/Self Study:** application of Chandaḥ Śāstra in designing of algorithms

| | | |
|---|---|---|
| **UNIT 4** | **Astronomy** | **04 HOURS** |

**Applications/Case Study:** Linear measures of celestial coordinate system.

**Contents:** Unique Aspects of Indian Astronomy, Historical Development, The Celestial Coordinate System, Elements of the Indian Calendar.

**Further Readings/Self Study:** Positional Astronomy.

| ACTIVITY(a) | Activity Based on IKS (25 Marks) | 01 HOUR |
|---|---|---|
| Activity based on the IKS will assess student's knowledge and comprehension of the course content. The purpose of the activity is to evaluate the participants' understanding and knowledge of IKS. | | |
| **ACTIVITY(b)** | **Field Visit and Report Writing (25 Marks)** | **08 HOURS** |

Students are required to conduct a field visit to the local places mentioned below.Upon completion of the field visit, students must write a report on the visit, its analysis,and submit the detail report for assessment

**Field Visit Guideline :**

**Archaeological Sites:** Visit archaeological sites like ancient temples and caves (Karla, Bhaja Bedse Caves, old temples) Vedic mathematics emphasizes geometric principles and formulas. These principles may have been applied in the design and construction of ancient temples and caves. These architecture often involves intricate geometric patterns and proportions, which could have been influenced by Vedic mathematical concepts.

**Museums:** Explore museums that exhibit ancient artifacts, tools, and techniques. (Raja Dinkar Kelkar Museum, Mahatma Phule Museum, Deccan College Museum, Darshan Museum) Observe any mathematical symbols, notations, or representations found in ancient artifacts. These can provide clues about how mathematical concepts were recorded and communicated in ancient times.

**Historical Monuments:** Visit historical sites featuring iconic artifacts. (Aga Khan Palace, Shaniwar Wada, Sinhgad Fort) Recognize the interdisciplinary nature of Vedic mathematics by understanding its connections to architecture, astronomy, and religious practices. Explore how mathematics played a role in these diverse fields. Appreciate the importance of preserving and conserving archaeological sites that offer insights into Vedic mathematics and ancient knowledge systems.

**Educational Institutions:** Visit universities or research institutes with metallurgy depart- ments. These institutions often have laboratories and facilities that demonstrate cutting-edge research in Mathematics e.g. Savitribai Phule Pune University, Indian Institute of Science Education and Research (IISER), College Technological University, Pune (COEP) Recognize how the mathematical achieve- ments of ancient India, including Vedic mathematics, continue to inspire modern mathematicians and educators.

| ACTIVITY(c) | Multimodal Activities (25 Marks) | 04 HOURS |
|---|---|---|

Students are required to perform any one activity as assessment and submit: The activity evaluates students understanding and application of Vedic Mathematics principles. It includes a range of mathematical problems and calculations based on Vedic techniques. Assessment criteria may encompass accuracy, speed, and proficiency in employing Vedic Math methods to problems.

**Poster Presentation:** Students are required to create a visually appealing and informative poster that summarizes a specific topic or concept related to the course. The poster should effectively convey key points, including information, visuals. Assessment criteria may include content clarity, visual design, organization, and the ability to articulate ideas during the presentation.

**Video Documentary:** Students are tasked with producing a short video documentary that explores a particular aspect of the course. This assessment component encourages students to research, script, film, and edit a video that presents their chosen topic in a compelling and informative manner. Evaluation criteria may include content accuracy, storytelling, production quality, and overall impact.

**Model Making:** In this task, students are asked to create a physical model or representation of a concept or object relevant to the course. The model should demonstrate a deep understanding of the subject matter and may include annotations or explanations to clarify its significance. Assessment criteria could include accuracy, creativity, craftsmanship, and the ability to explain the model's relevance.

**Product Making:** This component challenges students to design and produce a practical product or prototype related to the course content. Students design and craft practical products or prototypes inspired by Indian Knowledge System principles. This hands-on activity fosters creativity and practical application of IKS Students may need to consider materials, functionality, and how their product addresses a real-world problem or application. Evaluation might focus

## TEXT BOOKS


1. Mahadevan B., Pavana N., Bhat Vinayak R.,(2022). *Introduction to Indian Knowledge System: Concepts and Applications*. 1st Edition, PHI Learning. ISBN 978-9391818203.

2. Patil Chaitanya A.,(2018). *Learn Vedic Speed Mathematics Systematically and Step by Step*. 1st Edition, Chaitanya A. Patil Publication. ISBN 9789353008406.


## REFERENCE BOOKS


1. Bose, D. M. Sen, S.N. Subbarayappa,B. V. (2010). A Concise History of Science in India. 2nd Edition, Universities Press Publisher, Hyderabad. ISBN 9788173716195.
2. Boyer Carl B., (2011). A History of Mathematics. 3rd Edition. Wiley Publication. ISBN 9780470630563

3. Cooke Roger L. (2011). The History of Mathematics: A Brief Course. 2ND Edition. Wiley Publication. ISBN 9781118030240

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2026 - 2027 (Rev. 2023 (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Statistics and Integral Calculus |
| | **COURSE CODE** | 2301103T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301103T.CEO.1: To extend the basic concepts of integration for evaluation of complex integration problems.
2301103T.CEO.2: To categorize and use equation of curves to trace the given curve.
2301103T.CEO.3: To demonstrate an understanding towards evaluating multiple integrals.
2301103T.CEO.4: To relate and examine the applications of multiple integrals.
2301103T.CEO.5: To study different statistical methods for solving problems.
2301103T.CEO.6: To analyse different probability distribution functions.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301103T.CO.1: Evaluate complex integrals [L3].
2301103T.CO.2: Sketch curves by analysing the given equation of curves [L3].
2301103T.CO.3: Evaluate the multiple integrals [L3].
2301103T.CO.4: Apply the knowledge of multiple integrals to solve engineering problems [L3].
2301103T.CO.5: Assess statistical problems [L4].
2301103T.CO.6: Solve the probability distribution problems [L3].

## COURSE ABSTRACT

This course includes some of the main ideas on integral calculus, a wide domain of mathematics that has many applications relevant to the future engineer. Also included different methods of computing integrals and applications of multiple integrals as area, volume, centre of gravity and moment of inertia using different types of examples.Main objective of this course is to identify different methods to evaluate integrals, to demonstrate an understanding towards evaluating multiple integrals, to relate and examine the applications of multiple integrals, to analyze different probability distribution functions, to study different statistical methods for solving problems.It explains the concepts of probability theory and statistics which are needed for handling various real- world problems.As a part of the studies we emphasize more on real life applications of the topics and based on that different activities are also conducting in timely manner. By doing this we inculcate the curiosity of the students towards research.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Integral Calculus** | **08 HOURS** |

**Contents:** Reduction formulae, Gamma function, Beta function, Differentiation under integral sign.
**Self Study:** DUIS rule 2

| | | |
|---|---|---|
| **UNIT 2** | **Curve Tracing and Rectification** | **07 HOURS** |

**Applications/Case Study:** Rose Curves
**Contents:** Tracing of Curves: Cartesian curves, Parametric curves, Polar curves. Rectification: Rectification of Cartesian, Parametric and Polar curves .
**Self Study:** Parametric Curves .

| | | |
|---|---|---|
| **UNIT 3** | **Multiple Integrals** | **07 HOURS** |

**Contents:** Double integration, Evaluation of Double integration, Change of order of Integration, Integration by transforming Cartesian to polar coordinate systems, Triple Integration, Integration by transforming to spherical and cylindrical polar coordinates.
**Self Study:** Coordinate system.

| | | |
|---|---|---|
| **UNIT 4** | **Applications of Multiple Integrals** | **07 HOURS** |

**Contents:** Applications of multiple integrals to find Area, Volume, Centre of Gravity, and
**Self Study:** Moment of Inertia.

| | | |
|---|---|---|
| **UNIT 5** | **Statistics** | **08 HOURS** |

**Applications/Case Study:** Corona Graph.
**Contents:** Measures of central tendency, standard deviation, coefficient of variation, moments, skewness and kurtosis, correlation(Karl Pearson's coefficient of correlation) and regression .
**Self Study:** Measures of Central Tendency,Standard Deviation,Coefficient of Variation

| | | |
|---|---|---|
| **UNIT 6** | **Probability** | **08 HOURS** |

**Contents:** Probability, probability density function, probability distribution: Binomial, Poisson, Normal.
**Self Study:** Bayes' Theorem.

## TEXT BOOKS


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.


## REFERENCE BOOKS


1. Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379-8858). Addison-Wesley.
2. Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.
3. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.
4. Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.
5. O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.
6. Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.
7. Montgomery, D. C., & Runger, G. C. (2010). Applied statistics and probability for engineers. John wiley & sons.
8. Johnson, R. A., Miller, I., & Freund, J. E. (2000). Probability and statistics for engineers (Vol. 2000, p. 642p). London: Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2026 - 2027 (Rev. 2023 (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Statistics and Integral Calculus Tutorial |
| | **COURSE CODE** | 2301103U |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 1 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301103U.CEO.1: To extend the basic concepts of integration for evaluation of complex integration problems.
2301103U.CEO.2: To categorize and use equation of curves to trace the given curve.
2301103U.CEO.3: To demonstrate an understanding towards evaluating multiple integrals.
2301103U.CEO.4: To relate and examine the applications of multiple integrals.
2301103U.CEO.5: To study different statistical methods for solving problems.
2301103U.CEO.6: To analyse different probability distribution functions.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301103U.CO.1: Evaluate complex integrals [L3].
2301103U.CO.2: Sketch curves by analysing the given equation of curves [L3].
2301103U.CO.3: Evaluate the multiple integrals [L3].
2301103U.CO.4: Apply the knowledge of multiple integrals to solve engineering problems [L3].
2301103U.CO.5: Assess statistical problems [L4].
2301103U.CO.6: Solve the probability distribution problems [L3].

## COURSE ABSTRACT

This course includes some of the main ideas on integral calculus, a wide domain of mathematics that has many applications relevant to the future engineer. Also included different methods of computing integrals and applications of multiple integrals as area, volume, centre of gravity and moment of inertia using different types of examples.Main objective of this course is to identify different methods to evaluate integrals, to demonstrate an understanding towards evaluating multiple integrals, to relate and examine the applications of multiple integrals, to analyze different probability distribution functions, to study different statistical methods for solving problems.It explains the concepts of probability theory and statistics which are needed for handling various real- world problems.As a part of the studies we emphasize more on real life applications of the topics and based on that different activities are also conducting in timely manner. By doing this we inculcate the curiosity of the students towards research.

| **TUTORIALS** | | |
|---|---|---|
| **TUTORIAL NO.01** | **Integral Calculus** | **01 HOUR** |
| Reduction formulae, Gamma function. | | |
| **TUTORIAL NO.02** | **Integral Calculus** | **01 HOUR** |
| Beta function, DUIS Rule1 & 2. | | |
| **TUTORIAL NO.03** | **Curve Tracing** | **01 HOUR** |
| Tracing of Cartesian, Polar and Parametric curves. | | |
| **TUTORIAL NO.04** | **Rectification** | **01 HOUR** |
| Rectification of Cartesian, Polar and Parametric curves. | | |
| **TUTORIAL NO.05** | **Double Integration** | **01 HOUR** |
| Double Integration, Evaluation of Double Integration, Change the order of integration, Integration by transforming Cartesian to Polar Coordinate system. | | |
| **TUTORIAL NO.06** | **Triple Integration** | **01 HOUR** |
| Triple integration, Integration by transforming to spherical and cylindrical polar coordinates. Application Of multiple integrals: To find Area, Volume. | | |
| **TUTORIAL NO.07** | **Applications of Multiple Integrals** | **01 HOUR** |
| Applications of multiple integrals: To find Centre of Gravity of an arc, plane lamina and a solid. | | |
| **TUTORIAL NO.08** | **Applications of Multiple Integrals** | **01 HOUR** |
| Applications of multiple integrals: To find Moment of Inertia about an arc, plane and solid. | | |
| **TUTORIAL NO.09** | **Statistics** | **01 HOUR** |
| Measures of central tendency, standard deviation, coefficient of variation. | | |
| **TUTORIAL NO.10** | **Statistics** | **01 HOUR** |
| Moments, skewness and kurtosis, Correlation and regression. | | |

| | | |
|---|---|---|
| **TUTORIAL NO.11** | **Probability** | **01 HOUR** |
| Probability, probability density function. | | |
| **TUTORIAL NO.12** | **Probability** | **01 HOUR** |
| , Probability distribution: Binomial, Poisson, Normal. | | |
| **TUTORIAL NO.13** | **Guest Lecture** | **02 HOUR** |
| Applications of statistics in real life. | | |
| **TUTORIAL NO.14** | **Doubt Clearing Session** | **01 HOUR** |
| Unit 1 - Unit 6. | | |

**TEXT BOOKS**


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.


**REFERENCE BOOKS**


1. Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379-8858). Addison-Wesley.
2. Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.
3. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.
4. Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.
5. O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.
6. Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.
7. Montgomery, D. C., & Runger, G. C. (2010). Applied statistics and probability for engineers. John wiley & sons.
8. Johnson, R. A., Miller, I., & Freund, J. E. (2000). Probability and statistics for engineers (Vol. 2000, p. 642p). London: Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: 2026 - 2027 (Rev. 2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Engineering Physics |
| | COURSE CODE | 2301102T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

## COURSE OBJECTIVES :

2301102T.CEO.1: Make students identify the basic concept of measurements and to formulate problems in physical and mathematical terms.

2301102T.CEO.2: Analyze the behavior of light as a wave and get acquaint with different applications in Physics.

2301102T.CEO.3: Classify and understand the difference of classical mechanics and quantum mechanics.

2301102T.CEO.4: Derive the basic laws governing the motion of quantum particles.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301102T.CO.1: Make use of the basics of measurement aspects to obtain acceptable solutions under given conditions [L3].

2301102T.CO.2: Infer theoretical principles of optical phenomenon observed in daily life experience [L4].

2301102T.CO.3: Apply the knowledge of quantum mechanics to study the behavior of quantum particles [L3].

2301102T.CO.4: Analyze the necessity of quantum mechanics in context of failure of classical mechanics [L4].

## COURSE ABSTRACT

Since 'technology' has been generally understood as the application of 'science' to find answers to questions confronting us in a wide spectrum of inquiry, so a profound understanding of science is necessary to facilitate building sound intellectual capacity in the area of technology. Various areas of engineering studies are found to be applying concepts discussed in Physics as for instance measurement, optics, quantum-mechanics to name a few which have been instrumental/ pivotal in the development of Engineering branches like Robotics, Mechanical Engineering, Computer Science, Chemical Engineering, Civil Engineering and Electronics and Telecommunications; besides other specific allied areas as Artificial Intelligence, Big-Data Analysis and Quantum Computing. The course of Engineering Physics discusses the basics and analyses the understanding of topics like measurement of physical variables, wave-phenomenon, basics of Quantum Mechanics and its applications thereof. Most of the contents of this course act as a mandatory in terms of extrapolating its further extension to address the basics of Quantum Computing and other such emerging technologies.

## THEORY COURSE CONTENTS

| UNIT 1 | Measurement of Physical Quantities | 6 HOURS |
|---|---|---|

**Applications/Case Study:** Measuring methods in classical mechanics, measuring methods in quantum mechanics.

**Contents:** Concept of (i)significant numbers, (ii) accuracy versus precision (iii)error versus uncertainty (iv)systematic error versus random error (v) quantifying the uncertainty. Least-count of an apparatus, Methods to measure least-count with specific examples of travelling microscope and spectrometer. importance of estimation and guesstimation in measurement.

**Self Study:** Span (orders of magnitude) of prominent physical parameters. Length-scale and time-scale of specific physical phenomenon, classical-mechanical-measurement versus quantum-mechanical-measurement.

| UNIT 2 | Wave Properties of Light | 8 HOURS |
|---|---|---|

**Applications/Case Study:**Coating of lenses as an application of thin film interference.

**Contents:** Particle nature and wave-nature with examples of wave and particle behavior of light, Introduction to wave nature, Concept of thin film, Stokes law of phase-change on reflection from a thin film, Thin film interference, Interference in films of uniform and non-uniform thickness (with derivation), Newton Ring Experiment, basics of polarization of electromagnetic wave.

**Self Study:** Superposition Principle, Applications of thin-film interference, Diffraction as a particular case of interference, Application of polarized light.

| UNIT 3 | Quantum Mechanics-I | 8 HOURS |
|---|---|---|

**Applications/Case Study:** Plank's quantum law of blackbody radiation

**Contents:** Shortcomings or failure of Classical Mechanics (with specific example of blackbody radiation), Matter-waves, De-Broglie's concept of matter waves, Heisenberg's Uncertainty Principle.

**Self Study:** Blackbody radiation.

| UNIT 4 | Quantum Mechanics-II | 8 HOURS |
|---|---|---|

**Applications/Case Study:** Application of electron in a potential well in case of Bohr's atomic model.
**Contents:** Wave-function, Physical significance of wave function, Schrodinger's equations, Time Dependent and Time Independent forms of Schrodinger Equations, Applications of Schrodinger Equation, Electron in an infinite potential well (rigid box).
**Self Study:** Electron in a finite deep potential well (non-rigid box).
**Further Study:** Concept of quantum mechanical tunneling

## TEXT BOOKS


1. Feynman R.P., Leighton R.B., Sands M. (2013). The Feynman Lectures on Physics: (Vols.1-3) Narosa Publishing House.
2. Ghatak A. (2016). Optics (6th edition). TMH.


## REFERENCE BOOKS


1. Morris A.S. (2001). Measurement and Instrumentation Principles (3rd edition). Butterworth Heinemann.
2. Jenkins & White (2016). Fundamentals of Optics (4th edition). Mc Graw Hill Science.
3. Beiser A., Mahajan S., Choudhary S.R. (2009) Concepts of Modern Physics (6th edition). Mc Graw Hill Education (India) Pvt. Ltd.
4. Schiff L.I., Bandhyopadhyay J. (2017) Quantum Mechanics (4th edition). MH Education (India) Pvt. Ltd.
5. Dirac P.A.M. (2004) Principles of Quantum Mechanics (4th edition). CBS publishers and Distributors 2004.
6. Griffiths D.J. (2016) Introduction to Quantum Mechanics (2nd edition). Cambridge India.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: 2026 - 2027 (Rev. 2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Engineering Physics Lab |
| | COURSE CODE | 2301102L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

## COURSE OBJECTIVES :

2301102L.CEO.1: To acquire hands-on experience in setting up and using fundamental physics apparatus.

2301102L.CEO.2: To cultivate students' ability to conduct experiments, analyze data, and draw meaningful conclusions.

2301102L.CEO.3: Encourage students to identify sources of experimental error, and propose improvements.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301102L.CO.1: Demonstrate proficiency in using basic laboratory equipment relevant to physics experiments [L2].

2301102L.CO.2: Interpret the experimental data obtained from measurement of physical variables [L2].

2301102L.CO.3: Develop improved experimental-skills evidenced by their ability to identify sources of errors and propose appropriate precautions [L3].

## COURSE ABSTRACT

Since 'technology' has been generally understood as the application of 'science' to find answers to questions confronting us in a wide spectrum of inquiry, so a profound understanding of science is necessary to facilitate building sound intellectual capacity in the area of technology. Various areas of engineering studies are found to be applying concepts discussed in Physics as for instance measurement, optics, quantum-mechanics to name a few which have been instrumental/ pivotal in the development of Engineering branches like Robotics, Mechanical Engineering, Computer Science, Chemical Engineering, Civil Engineering and Electronics and Telecommunications; besides other specific allied areas as Artificial Intelligence, Big-Data Analysis and Quantum Computing. The course of Engineering Physics discusses the basics and analyses the understanding of topics like measurement of physical variables, wave-phenomenon, basics of Quantum Mechanics and its applications thereof. Most of the contents of this course act as a mandatory in terms of extrapolating its further extension to address the basics of Quantum Computing and other such emerging technologies.

**PRACTICALS**: Seven (7) number of experiments among those listed below to be conducted. Maximum two experiments may be substituted (by faculty in consultation with students) with Experimental hands-on activity/ies among those listed below.

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Interpretation of given data** | **2 HOURS** |
| Analysis of a given data set in terms of implied uncertainties and tolerance to evaluate validity of a result. (Note: The given data may be in terms of graph as well). | | |
| **PRACTICAL NO.02** | **Estimation and guesstimation** | **2 HOURS** |
| To predict the expected outcome of a given experimental problem under scientific reasoning justifying the experimental conditions. | | |
| **PRACTICAL NO.03** | **Significant Figures** | **2 HOURS** |
| Determination of the mass of electron (me) upto specified significant numbers. | | |
| **PRACTICAL NO.04** | **Interference of Light Waves** | **2 HOURS** |
| Calculate the refractive index of a given liquid using Newton Rings' Experiment. | | |
| **PRACTICAL NO.05** | **Diffraction of Light Waves** | **2 HOURS** |
| Determination of the line density of a diffraction grating using Laser. | | |
| **PRACTICAL NO.06** | **Interference of Light Waves** | **2 HOURS** |
| Calculate the wavelength of Sodium light source using Michelson Interferometer. | | |
| **PRACTICAL NO.07** | **Phase and Phase-Difference** | **2 HOURS** |
| Determination of the phase-difference between two given positions on the path of simple pendulum in periodic motion. | | |
| **PRACTICAL NO.08** | **Polarization** | **2 HOURS** |
| Determination of the specific rotation of a sugar solution of a given concentration. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.9** | **Division of Amplitude of Light Waves** | **2 HOURS** |
| Determination of Radius of Curvature of a given planoconvex lens using Newton's Rings apparatus. | | |
| **PRACTICAL NO.10** | **Diffraction as a Particular Case of Interference** | **2 HOURS** |
| Calculation of wavelength of different colors using a white light. | | |
| **PRACTICAL NO.11** | **Malus' Law** | **2 HOURS** |
| Verification of Malus' law under experimental conditions. | | |
| **PRACTICAL NO.12** | **Brewster's Law** | **2 HOURS** |
| Determination of refractive index of given unknown material. | | |
| **Hands-on Activity No.1** | **Wave/ Quantum mechanics: Effect of measurement on the state of an observable** | **4 HOURS** |
| Measuring the change in state of an observable using Malus' law under experimental conditions. | | |
| **Hands-on Activity No.2** | **Significant digits in experimental result** | **2 HOURS** |
| Number of significant digits in the obtained result as a function of different methods used to determine a physical variable/ observable. | | |

## TEXT BOOKS


1. Worsnop B.L., Flint H.T. (2002). Advanced practical Physics for students. Methuen & Co. Ltd. https://archive.org/details/in.ernet.dli.2015.86393/page/n7/mode/2up.
2. Ghatak A. (2021). The ten most beautiful experiments in science. (1st edition). Viva Books.


## REFERENCE BOOKS


1. Worsnop B.L., Flint H.T. (2002). Advanced practical Physics for students. Methuen & Co. Ltd. https://archive.org/details/in.ernet.dli.2015.86393/page/n7/mode/2up.
2. Ghatak A. (2021). The ten most beautiful experiments in science. (1st edition). Viva Books.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev.2023 (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Introduction to Electrical & Electronics Engineering |
| | **COURSE CODE** | 2307102T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307102T.CEO.1: To impart knowledge of single-phase & Three-phase AC circuits.
2307102T.CEO.2: To get acquainted with single-phase transformers & DC Motors.
2307102T.CEO.3: To familiarize with Analog & Digital circuits.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307102T.CO.1: Illustrate Single Phase & Three phase AC Systems [L2].
2307102T.CO.2: Articulate use of single-phase transformers & DC Motors in industrial Applications [L2].
2307102T.CO.3: Design analog & digital circuits using suitable components [L3].

**COURSE ABSTRACT:**

This course is designed to cater specific needs of Hardware Engineers for applications of **Electrical and Electronics Engineering.** This comprehensive course provides students with a solid foundation in the principles, theories, and practical applications of Electrical and Electronics Engineering. The students will delve into the **fundamental concepts of AC electrical circuits, Single Phase & Three phase AC power systems.**

The course focuses on developing fundamental technical concepts in a comprehensible, coherent, and rigorous way. The student will explore **Single phase Transformers & DC Motors.** The students will get insight to practical know-how about **Analog Electronics & DC Power Supply Design.** The students will also explore the intricate world of **Digital Electronic Systems and their applications.**

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Single Phase Electrical Systems** | **06 HOURS** |

**AC fundamentals:** Basic Electrical elements, AC fundamentals, AC and DC Systems, Single phase AC systems.

**Measurements:** Peak and RMS Value, Phase difference, Leading & Lagging Waveforms, Concept of Power factor, Power factor improvement.

**Computations:** Tariffs, Power ratings of home appliances (fan, tube light, mixer etc), Calculation of power & Load requirements.

**Activity/Case Study:** Energy Consumption calculation for Residential or Commercial Complex

**Further Readings/Self Study:** Energy Conservation & Energy Audit, Alternate & Clean Energy

| | | |
|---|---|---|
| **UNIT 2** | **Three Phase star & Delta systems** | **06 HOURS** |

**Three Phase systems:** Comparison of Single and Three Phase AC power systems, Structure of Three phase AC power systems, Three phase quantities, Role of Neutral connection.

**Delta and Star connections:** Relation between line and phase quantities (with phasor diagrams),Power in three phase circuits for Star and Delta connections.

**Activity:** Overview of Indian Power System Scenario by year 2030. (Flipped Classroom)

**Further Readings/Self Study:** Selections of Star and Delta Connections as per load requirements.

| | | |
|---|---|---|
| **UNIT 3** | **Single phase Transformers and DC Motors** | **07 HOURS** |

**Single Phase Transformers:** Construction, Types, Working Principle, EMF equation, Efficiency.

**DC Motors:** Construction, Working principle, Types of DC Motors, Speed-Torque characteristics, Selection of motor for applications.

**Activity:** Study of Motors used in Various applications.

**Further Readings/Self Study:** PMDC, BLDC, Stepper motor, Single Phase AC Motors.

| | | |
|---|---|---|
| **UNIT 4** | **Analog Electronics and DC Power Supply Design** | **06 HOURS** |

**BJT:** Configurations, DC Load Line, Q-point, BJT as a Switch & Amplifier.

**DC Power Supply Design:**DC Regulated power supply, Design of DC Regulated Power Supply.

**Activity:** Build & simulate power supply circuit using any simulation software.

**Further Readings/Self Study:** Study of rectifier Circuits, SMPS.

| UNIT 5 | Digital Electronics Systems | 07 HOURS |
|---|---|---|

**Digital Systems:** Analog & Digital Electronic signals, Analog Vs. Digital Electronics systems, Number systems, Logic gates, Logic design with Sum of Products (SOP), K-Map
**Combinational Circuits:** : Adders, Subtractors, Multiplexers
**Sequential circuits:** : Flip-Flops, Registers.
**Applications/Case Study:** K-Map Puzzle.
**Further Readings/Self Study:** Digital Circuit Simulators.

| ASSESSMENTS | | |
|---|---|---|
| **Assessment Head** | **Syllabus** | **CO** |
| **MSE (20 Marks)** | Unit 1 & 2 | CO1 |
| **ESE (40 Marks)** | Unit 3, 4 & 5 | CO2,CO3 |
| **IA (15 Marks) Activities** | i) Calculation of Electricity Bill (10 Marks) | CO1 |
| | ii) Online Quiz (05 Marks) | CO2 |

## TEXT BOOKS


1. Edward Hughes. (2011). *Electrical and Electronic Technology*. 10th Edition, Pearson India. ISBN-13:978-8131733660 .
2. Thomas L. Floyd. (2018). *Electronics Devices*. 10th Edition, Pearson Education India. ISBN-13:978-1292222998
3. A. Anand Kumar. (2016). *Fundamentals of Digital Circuits*. 4th Edition, Prentice Hall of India. ISBN-13:978-8120352681 .
4. Ronald Tocci,Neal Widmer. (2016). *Digital Systems: Principles and Applications*. 12th Edition, Pearson India. ISBN-13:978-1292162003


## REFERENCE BOOKS


1. V.N. Mittle & Arvind Mittal. (2005). *Basic Electrical Engineering*. 2nd Edition,McGraw Hill Education. ISBN-13: 978-0070593572.
2. Paul Horowitz, Winfield Hill. (2016). *The Art of Electronics*. 3rd Edition, Cambridge University press. ISBN-13: 978-0521809269
3. D. P. Kothari, I.J. Nagrath. (2010). *Electric Machines*. 4th Edition, McGraw Hill. ISBN-13: 978-0070699670.
4. M. Morris Mano, Michael D. Ciletti. (2023). *Digital design*. 5th Edition, Pearson India. ISBN-13: 978-0131989245.

**E-RESOURCES**

1. NPTEL Online Course *Digital Electronic Circuits*, Prof. Goutam Saha , IIT Kharagpur
   https://onlinecourses.nptel.ac.in/noc22_ee55/preview
2. First Year Engineering Programme (Semester 2): Digital Electronics-NYP Singapore
   https://nyp-sg.libguides.com/c.php?g=921528&p=6659059
3. Digital Electronic Circuits Virtual Lab,IIT Kharagpur.
   http://vlabs.iitkgp.ac.in/dec/index.html

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev.2023(NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Introduction to Electrical & Electronics Engineering Lab |
| | **COURSE CODE** | 2307102L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307102L.CEO.1: To impart knowledge of single-phase & Three-phase AC circuits..
2307102L.CEO.2: To get acquainted with single-phase transformers & DC Motors.
2307102L.CEO.3: To familiarize with Analog & Digital circuits.
2307102L.CEO.4: To develop analog / digital application circuit in a team.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307102L.CO.1: Illustrate Single Phase & Three phase AC Systems [L2].
2307102L.CO.2: Articulate use of single-phase transformers & DC Motors in industrial Applications [L2].
2307102L.CO.3: Implement analog & digital circuits using suitable components [L3].
2307102L.CO.4: Build simple Analog /Digital logic applications in a team [L3].

**COURSE ABSTRACT:**

This course is designed to cater specific needs of Hardware Engineers for applications of **Electrical and Electronics Engineering.** This comprehensive course provides students with a solid foundation in the principles, theories, and practical applications of Electrical and Electronics Engineering. The students will delve into the **fundamental concepts of AC electrical circuits, Single Phase & Three phase AC power systems.**

The course focuses on developing fundamental technical concepts in a comprehensible, coherent, and rigorous way. The student will explore **Single phase Transformers & DC Motors.** The students will get insight to practical know-how about **Analog Electronics & DC Power Supply Design.** The students will also explore the intricate world of **Digital Electronic Systems and their applications.**

| **PRACTICALS** | | |
|---|---|---|
| **ACTIVITY NO.01** | **AC Fundamentals** | **2 HOURS** |
| Measurement of basic AC quantities using DSO | | |
| **PRACTICAL NO.01** | **Star & Delta three phase systems** | **2 HOURS** |
| Measurement of Line & Phase quantities for Star &Delta connections | | |
| **PRACTICAL NO.02** | **Regulated DC Power Supply design** | **2 HOURS** |
| Design & Implementation of Regulated DC Power Supply | | |
| **PRACTICAL NO.03** | **BJT as a Switch and Amplifier** | **2 HOURS** |
| Verify operation of BJT in Switching mode & Amplifier mode | | |
| **PRACTICAL NO.04** | **Logic Gates** | **2 HOURS** |
| Verify operation of various Logic Gates & Universal logic gates | | |
| **ACTIVITY NO.02** | **Simulation of DC Motor control circuit** | **2 HOURS** |
| Simulate DC Motor control circuit with suitable simulation software | | |
| **PRACTICAL NO.05** | **Design of Half adder & Full adder** | **2 HOURS** |
| Design Half adder and Full adder circuit with K map simplification | | |
| **PRACTICAL NO.06** | **Group Project** | **12 HOURS** |
| Project & Demonstration | | |

| ASSESSMENTS | | |
|---|---|---|
| **Assessment Head** | **Syllabus** | **CO** |
| **CA (20 Marks)**<br><br>**Activities** | i) Measurement of AC quantities (05 Marks)<br>ii) Simulation of DC Motor control circuit (05 Marks)<br>iii) Performance of Experiments (10 Marks) | CO1<br>CO2<br>CO1, CO2, CO3 |
| **Demo (30 Marks)** | A laboratory Group project based on,<br>i) Theme: Analog/Digital Circuits with DC Motor<br>ii) Team Size: 03 to 04 Students<br>iii) No Micro-controller/Only Discrete components | CO3, CO4 |

## TEXT BOOKS


1. Edward Hughes. (2011). *Electrical and Electronic Technology*. 10th Edition, Pearson India. ISBN-13: 978-8131733660 .
2. Thomas L. Floyd. (2018). *Electronics Devices*. 10th Edition, Pearson Education India. ISBN-13: 978-1292222998
3. A. Anand Kumar. (2016). *Fundamentals of Digital Circuits*. 4th Edition, Prentice Hall of India. ISBN-13: 978-8120352681 .
4. Ronald Tocci,Neal Widmer. (2016). *Digital Systems: Principles and Applications*. 12th Edition, Pearson India. ISBN-13: 978-1292162003


## REFERENCE BOOKS


1. V.N. Mittle & Arvind Mittal. (2005). *Basic Electrical Engineering*. 2nd Edition,McGraw Hill Education. ISBN-13: 978-0070593572.
2. Paul Horowitz, Winfield Hill. (2016). *The Art of Electronics*. 3rd Edition, Cambridge University press. ISBN-13: 978-0521809269
3. D. P. Kothari, I.J. Nagrath. (2010). *Electric Machines*. 4th Edition, McGraw Hill. ISBN-13: 978-0070699670.
4. M. Morris Mano, Michael D. Ciletti. (2023). *Digital design*. 5th Edition, Pearson India. ISBN-13: 978-0131989245.


## E-RESOURCES

1. NPTEL Online Course, *Digital Electronic Circuits*, Prof. Goutam Saha, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc22_ee55/preview
2. First Year Engineering Programme (Semester 2):Digital Electronics-NYP Singapore https://nyp-sg.libguides.com/c.php?g=921528&p=6659059
3. Digital Electronic Circuits Virtual Lab,IIT Kharagpur. http://vlabs.iitkgp.ac.in/dec/index.html

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF COMPUTER ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev. 2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Essentials of Data Science |
| | COURSE CODE | 2304102T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : -- | REVISION NO. | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PRE-REQUISITE :**

**COURSE OBJECTIVES :**

2304102T.CEO.1: To get familiar with the basics of Python programming.
2304102T.CEO.2: To learn different data structures in Data Science.
2304102T.CEO.3: To use data computation methods in Data Science.
2304102T.CEO.4: To introduce data manipulation methods in Data Science.
2304102T.CEO.5: To use data visualization methods in Data Science.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304102T.CO.1: Build a python program for handling syntax and semantics for any given problem[L3].
2304102T.CO.2: Demonstrate proficiency in handling data structures useful in Data Science[L3].
2304102T.CO.3: Apply the suitable methods of data computations on real time data[L3].
2304102T.CO.4: Interpret the different methods of data manipulation on real time data[L3].
2304102T.CO.5: Apply data visualization for real time data to get better insights[L3].

## COURSE ABSTRACT

Essentials of Data Science (EDS) is the First Year Semester-II course. This course aims at equipping learners to be able to provide the essence of Data Science by using python programming. In this course, firstly, the learners will learn python fundamentals required for Data Science. The learners are able to use different data organizational structures to store the real time data. Data computations are required to maintain the quality of data. EDS helps to learn different data computations. Data manipulations help in handling missing and noisy values in Data Processing. The learner will learn data storing, loading, cleaning, preparation, wrangling, transformation etc. Data visualization is the practice of translating information into a visual context, such as a map or graph which tends to identify the patterns, trends from the data. This course will increase the learner's interest in Data Science. The activity based learning is adapted to learn this course.

## THEORY COURSE CONTENT

| UNIT 1 | Python Fundamentals for Data Science | 6 HOURS |
|---|---|---|

**App/System/Case study:**Weather Analysis

**Contents:**Introduction, Data Types- Mutable and immutable types, Data Conditioning using Decision Statements and Iterative Statements.

Functions: Basics of functions, variable scope and lifetime, Lambda or anonymous function.

Modules: Introduction to modules, packages and standard library modules.

Data Handling using Files.

**Self Study:**CSV Reader and Writer

**Further Reading:**Excel Reader and Writer

| UNIT 2 | Data Organizational Structures | 6 HOURS |
|---|---|---|

**App/System/Case study:**Retail-Industry/Twitter Reviews

**Contents:**Categories of Data- Unstructured, Structured, Categorical and Time Series

List- Creating List, List operations

Tuple- List of Tuples, Immutability,

Dictionaries- Creating Dictionary, Adding to Dictionary with SetDefault, Loading JSON to Dictionary

Set- Removing Data from Sequences, Performing common data set operation

**Self Study:**JSON File Handling

**Further Reading:**XML File Handling

| UNIT 3 | Data Computation | 6 HOURS |
|---|---|---|

**App/System/Case study:**Stock Market

**Contents:**Data Operations- Arithmetic and Statistical, Bitwise Operators, Linear Algebra, Copying and viewing data in arrays, Stacking, Data Sorting, Data Searching and Indexing, Data counting, Mathematical Operations, Broadcasting, Matrix Operations, Structured Data.

**Self Study:**Fancy Indexing

**Further Reading:**Parallel Processing using Arrays

| UNIT 4 | Data Manipulation | 6 HOURS |
|---|---|---|

**App/System/Case study:**Salary Analysis

**Contents:**Data Loading, Data Storage, Summarizing and Computing Descriptive Statistics, Data Cleaning, Data Preparation, And Data Wrangling: Join, Combine, and Reshape, Data Transformation, Data Aggregation and Group Operations.

**Self Study:**Working on XML and JSON

**Further Reading:**Data Profiling

| UNIT 5 | Data Distribution and Visualization | 6 HOURS |
|---|---|---|

**App/System/Case study:**Sales

**Contents:**Population and Samples

Data Distribution- Statistical Analysis of Data, Data Analytics Techniques; Descriptive, Predictive and Prescriptive, Normal Distribution Significance of Data Visualization in Data Science, Plots- Line Chart, Bar Plot, Histogram, Scatter Plot, Pie Chart, Density Plot, Facet Grids for categorical data, Group Plots

**Self Study:** 3D Visualizations

**Further Reading:**Supervised Learning - Classification-KNN, Regression-Simple Linear Regression

## TEXT BOOK


1. VanderPlas, J. (2016). Python data science handbook: Essential tools for working with data. " O'Reilly Media, Inc.".
2. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".
3. McKinney, W. (2017). Python for data analysis, " O'Reilly Media, Inc".
4. Brownley, C. W. (2016). Foundations for Analytics with Python: From Non-Programmer to Hacker. " O'Reilly Media, Inc.".


## REFERENCE BOOK


1. Mueller, J. P., & Massaron, L. (2019). Python for data science for dummies. John Wiley & Sons.
2. Grus, J. (2019). Data science from scratch: first principles with python. O'Reilly Media.
3. Kane, F. (2017). Hands-on data science and python machine learning. Packt Publishing Ltd.
4. Madhavan, S. (2015). Mastering python for data science. Packt Publishing Ltd.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF COMPUTER ENGINEERING** | **W.E.F** | **AY:** 2026 - 2027 (Rev. 2023 NEP) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Essentials of Data Science Lab |
| | **COURSE CODE** | 2304102L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE :**

**COURSE OBJECTIVES :**

2304102L.CEO.1: To get familiar with the basics of Python programming.
2304102L.CEO.2: To learn different data structures in Data Science.
2304102L.CEO.3: To use data computation methods in Data Science.
2304102L.CEO.4: To introduce data manipulation methods in Data Science.
2304102L.CEO.5: To use data visualization methods in Data Science.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304102L.CO.1: Build a python program for handling syntax and semantics for any given problem[L3].
2304102L.CO.2: Demonstrate proficiency in handling data structures useful in Data Science[L3].
2304102L.CO.3: Apply the suitable methods of data computations on real time data[L3].
2304102L.CO.4: Interpret the different methods of data manipulation on real time data[L3].
2304102L.CO.5: Apply data visualization for real time data to get better insights[L3].

## COURSE ABSTRACT

Essentials of Data Science (EDS) is the First Year Semester-II course. This course aims at equipping learners to be able to provide the essence of Data Science by using python programming. In this course, firstly, the learners will learn python fundamentals required for Data Science. The learners are able to use different data organizational structures to store the real time data. Data computations are required to maintain the quality of data. EDS helps to learn different data computations. Data manipulations help in handling missing and noisy values in Data Processing. The learner will learn data storing, loading, cleaning, preparation, wrangling, transformation etc. Data visualization is the practice of translating information into a visual context, such as a map or graph which tends to identify the patterns, trends from the data. This course will increase the learner's interest in Data Science. The activity based learning is adapted to learn this course.

**PRACTICAL:Perform following experiments using python programming language.**

| **PRACTICAL NO.01** | | **6 HOURS** |
|---|---|---|

**Practice Lab Assignments:**

1. To accept an object mass in kilograms and velocity in meters per second and display its momentum. Momentum is calculated as e=mc2 where m is the mass of the object and c is its velocity.
2. Write a Python program for following conditions.
   If n is single digit print square of it.
   If n is two digit print square root of it.
   If n is three digit print cube root of it.
3. Read the birth date and salary in rupees of employees. Perform data transformation for birthdate to age and also salary which is in rupees to salary in dollars using functions.
4. Print the reverse number of a given number,

**Lab Assignment:**

1. To accept students five courses marks and compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course.
If student scores aggregate greater than 75 percentage, then the grade is distinction.
If aggregate is greater than or equal to 60 and less than 75 then the grade if first division.
If aggregate is greater than or equal 50 and less than 60, then the grade is second division.
If aggregate is greater than or equal 40 and less than 50, then the grade is third division.
2. Solve the Fibonacci sequence using recursive function in Python.
3. Write a Python program to print different patterns.

**Self Study Assignment:**

Perform all statistical analysis (Average, Max, Min, Sum, on emplyoee data.

| PRACTICAL NO.02 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Perform all List Operations, Dictionary Operations.

**Lab Assignment:**

1. Select the number from the entered list and find its position in Python (use Linear Search).
2. Choose cricket team of eleven players find the captain of the team (consider tallest person as a captain) using dictionary.

**Self Study Assignment:** 1. Consider the student subjects marks are stored in the list. Find the total marks and percentage of students.

2. Perform all tuple operations.

| PRACTICAL NO.03 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Perform all the Numpy operations in python.

**Lab Assignment:**

Prepare/Take dataset for any real life application. Read a dataset into an array. Perform following operations on it as:

- Perform all matrix operations
- Horizontal and vertical stacking of Numpy Arrays
- Custom sequence generation
- Arithmetic and Statistical Operations, Mathematical Operations, Bitwise Operators
- Copying and viewing arrays
- Data Stacking, Searching, Sorting, Counting, Broadcasting

**Self Study Assignment:** For any real life application, perform advanced data operations such as image as array and image manipulations.

| PRACTICAL NO.04 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Perform all the pandas operations in python.

**Lab Assignment:** Read any real life dataset. Store the data into Data Frames. Identify 10 grains for the given dataset. Implement all 20 grains using Pandas methods. The Sample Grains for Sales Dataset as:

- Which was the best month for sales? How much was earned that month?
- Which product sold the most? Why do you think it did?
- Which city sold the most products?
- What Products are most often sold together?

**Self Study Assignment:** For any real life application, perform advanced Data Manipulation operations such as combining data, handling time series data.

| PRACTICAL NO.05 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Install MatPlotLib library. Draw basic graphs for sales dataset using MatPlotLib.

**Lab Assignment:**

For Titanic dataset, Perform data analysis. Identify 5 grains for a given dataset. Perform a data visualization for those grains using the MatPlotLib library. (Use any 5 different graphs with proper title, legends, axis names, etc.to map identified grains)

**Self Study Assignment:** 1. For any real life application, perform advanced graphs for data visualization such as Span Selector, Broken Barh-Broken Horizontal Bar plot, Watermarking Images with Matplotlib.

2. Apply Linear Regression and K-Nearest Neighbour Classifier on a real time dataset.

## TEXT BOOK


1. VanderPlas, J. (2016). Python data science handbook: Essential tools for working with data. " O'Reilly Media, Inc.".
2. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".
3. McKinney, W. (2017). Python for data analysis, " O'Reilly Media, Inc".
4. Brownley, C. W. (2016). Foundations for Analytics with Python: From Non-Programmer to Hacker. " O'Reilly Media, Inc.".


## REFERENCE BOOK


1. Mueller, J. P., & Massaron, L. (2019). Python for data science for dummies. John Wiley & Sons.
2. Grus, J. (2019). Data science from scratch: first principles with python. O'Reilly Media.
3. Kane, F. (2017). Hands-on data science and python machine learning. Packt Publishing Ltd.
4. Madhavan, S. (2015). Mastering python for data science. Packt Publishing Ltd.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev.2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Integrating Sensors and actuators |
| | COURSE CODE | 2307162T |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | PRACTICAL | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307162T.CEO.1: To make students familiar with the constructions and working principle of different types of sensors and actuators

2307162T.CEO.2: To make students aware about the Data Acquisition System

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307162T.CO.1: Discuss criteria for selecting sensors, actuators and microcontrollers based on specific application requirements[L2].

2307162T.CO.2: Explain the working principle of sensors, actuators and signal conditioning circuits[L2].

## COURSE ABSTRACT

In today's technology-driven world, electronic skills are increasingly important. This proposed course provides students with theoretical knowledge of measurement system with Sensors, signal conditioning techniques , actuators and Micro-controller. This knowledge helps students for enhancing their problem-solving skills and critical thinking abilities.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Microcontroller based Measurement System** | **03 HOURS** |

**Applications/Case Study:** Weighing Machine

**Contents:** Block diagram, Weighing Sensors, Signal Conditioning for weighing system, Types of weighing machine, Specifications.

**Self Study: Microntroller Based Wireless Recorder for Biomedical Signals** .

| | | |
|---|---|---|
| **UNIT 2** | **Speed Control of Motor Using Microcontroller** | **03 HOURS** |

**Applications/Case Study:** Microcontroller Based Speed Controller

**Contents:** Block Diagram,Encoders,Speed Measurement, Actuation of Motor

**Self Study: Types of DC Motor** .

## TEXT BOOKS

1. B. C. Nakra, K.K. Choudhury, (2009), *Instrumentation, Measurement and Analysis*, 3rd edition, Tata McGraw.
2. Jacob Fraden, (2010), *Hand Book of Modern Sensors: physics, Designs and Applications*, 3rd edition, Springer.
3. Edward Sazonov, Michael R Neuman, (2014), *Wearable Sensors: Fundamentals, Implementation and Applications*, Elsevier.

## REFERENCE BOOKS

1. Soumitra Kumar Mandal, (2011), *Microprocessors and Microcontrollers Architecture, Programming & Interfacing Using 8085, 8086 And 8051*, Tata McGraw Hill, India.
2. Jon. S. Wilson, (2005), *Sensor Technology Hand Book*, Elsevier Inc.
3. Murthy, D.V.S., (2003), *Transducers and Instrumentation*, Prentice Hall of India.
4. Shawhney A. K., (1999), *A Course In Electrical and Electronics Measurements and Instrumentation*, Dhanpat Rai & Sons, 11th edition.
5. Ramon Pallas-Areny and John G Webster, (2012), *Sensors and Signal Conditioning*, 2nd edition, Wiley India Pvt. Ltd.
6. Doebelin. E.A, (2000), *Measurement Systems - Applications and Design*, Tata McGraw Hill,New York.
7. Patranabis. D, (2000), *Sensors and Transducers*, Prentice Hall of India.
8. John. P, Bentley, (2000), *Principles of Measurement Systems*, 3rd edition, Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev.2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Integrating Sensors and actuators Lab |
| | COURSE CODE | 2307162L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | PRACTICAL | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 20 | 40 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307162L.CEO.1: To make students familiar with the constructions and working principle of different types of sensors and actuators

2307162L.CEO.2: To make students aware about the Data Acquisition System

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307162L.CO.1: Survey different electronics components by forming a group to work in a team for Data Acquisition System. [L4].

2307162L.CO.2: Select Sensors, Actuators and Signal Conditioning Circuit for particular applications. [L3].

2307162L.CO.3: Design Data Acquisition System using Sensors, Actuators, Signal Conditioning Circuit and Microcontroller [L3].

2307162L.CO.4: Take part in oral presentation by doing independent study of Datasheets and Data Acquisition System.[L4].

## COURSE ABSTRACT

In today's technology-driven world, electronic skills are increasingly important. This proposed course provides students with practical, hands-on experience in working with Sensors, data acquisition system, signal conditioning techniques and actuators. The contents of this course involve designing, building, and measuring electronic circuits and projects. This hands-on experience helps students to bridge the gap between theoretical knowledge and practical application, enhancing their problem-solving skills and critical thinking abilities

## PRACTICAL GUIDELINES

1. Every student group(max.4) will select a title for Data Acquisition System
2. Students have to identify the problem related to Data Acquisition System through real life examples, expert opinions and various research articles.
3. The group members will select the appropriate electronics components, sensors, signal conditioning circuit, actuators and microcontroller by referring the data sheet.
4. Students have to carry step by step Simulation of Data acquisition System
5. Students have to do hardware implementation of the same system

## PRACTICALS

| PRACTICAL NO.01 | | 4 HOURS |
|---|---|---|

**Identification and Finalization of Problem Statement of any Data Acquisition System**

- Identification and Finalization of Data Acquisition System with following electronic components -Sensor, Actuator, Signal Conditioning circuit and Microcontroller

| PRACTICAL NO.02 | | 4 HOURS |
|---|---|---|

**Selection of components Required for Design of Data Acquisition System**

- Identification of Different sensors and actuators in Electronic System.
- Introduction to Simple Electrical and Mechanical actuator and Microcontroller.
- Select suitable Sensor, Actuator, Signal conditioning circuit Microcontroller, power supply, and Microcontroller for Data acquisition system

| PRACTICAL NO.03 | | 4 HOURS |
|---|---|---|

**Interpretation of Data sheets**

- Interpret data sheets of all the components of Data Acquisition System.
- Introduction to the Simulation Tool to simulate electronic circuit.

| PRACTICAL NO.04 | | 6 HOURS |
|---|---|---|

**Simulation of Data Acquisition System**

- Implementation of simple Signal Conditioning Circuit
- Simulate simple Data Acquisition System using electronic Components

| PRACTICAL NO.05 | | 6 HOURS |
|---|---|---|

**Testing of electronic components of selected Data Acquisition System**

- Testing of electronic Components sensors, actuators, signal conditioning circuit and Microcontroller.

| PRACTICAL NO.06 | | 4 HOURS |
|---|---|---|

**Hands on with different components of Data Acquisition System.**

- Implementation on Bread Board and Analysis of system.
- Analysis of Input and Output of Data Acquisition System using different modules
- Hands on with different interfacing modules used in Data Acquisition System and measuring instruments like function generator, display units, CRO, DSO and multimeter,

| PRACTICAL NO.07 | | 6 HOURS |
|---|---|---|

**Assembly and Final demonstration of Data Acquisition System**

- Assembling of all components of Data Acquisition System and show the final output

## TEXT BOOKS


1. B. C. Nakra, K.K. Choudhury, (2009), *Instrumentation, Measurement and Analysis*, 3rd edition, Tata McGraw.
2. Jacob Fraden, (2010), *Hand Book of Modern Sensors: physics, Designs and Applications*, 3rd edition, Springer.
3. Edward Sazonov, Michael R Neuman, (2014), *Wearable Sensors: Fundamentals, Implementation and Applications*, Elsevier.

## REFERENCE BOOKS


1. Soumitra Kumar Mandal, (2011), *Microprocessors and Microcontrollers Architecture, Programming & Interfacing Using 8085, 8086 And 8051*, Tata McGraw Hill, India.
2. Jon. S. Wilson, (2005), *Sensor Technology Hand Book*, Elsevier Inc.
3. Murthy, D.V.S., (2003), *Transducers and Instrumentation*, Prentice Hall of India.
4. Shawhney A. K., (1999), *A Course In Electrical and Electronics Measurements and Instrumentation*, Dhanpat Rai & Sons, 11$^{th}$ edition.
5. Ramon Pallas-Areny and John G Webster, (2012), *Sensors and Signal Conditioning*, 2$^{nd}$ edition, Wiley India Pvt. Ltd.
6. Doebelin. E.A, (2000), *Measurement Systems - Applications and Design*, Tata McGraw Hill,New York.
7. Patranabis. D, (2000), *Sensors and Transducers*, Prentice Hall of India.
8. John. P, Bentley, (2000), *Principles of Measurement Systems*, 3$^{rd}$ edition, Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev.2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Logic Sensing and Actuation |
| | COURSE CODE | 2307111T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : -- | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | PRACTICAL | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307111T.CEO.1: Explain the use of sensors, Actuators, Signal Conditioning Circuits and Microcontrollers for a Data Acquisition Systems

2307111T.CEO.2: Get acquainted with the role of of sensors, Actuators Signal conditioning Circuits and Microcontrollers in a Data Acquisition

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307111T.CO.1: Illustrate different types of sensors, Actuators, Signal conditioning Circuits and Microcontrollers for a Data Acquisition Systems [L2].

2307111T.CO.2: Develop a Data Acquisition System for Measurement of Physical Parameters[L3].

## COURSE ABSTRACT

Many opportunities in the field of E&TC engineering, Electrical engineering, Computer engineering, Robotics, IoT (Internet of Things), and even fields like industrial design, require a strong foundation in electronics. The proposed course equips students with the foundational skills needed to excel in these fields. The skills such as selecting sensors and actuators, designing data acquisition system electronic instruments working with components are essential for anyone considering in Electronics or Electronics and Telecommunication Engineering degree which will enhance their analytical skills and persistence in solving complex problems.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Data Acquisition System** | **04 HOURS** |

**Applications/Case Study:** Temperature Measurement System

**Contents:** Block Schematic,Role of Sensor,Significance of Signal Conditioning, Actuators and Micro-controllers in Data Acquisition System, Concept of Feedback.

**Self Study:** Weather Information Display System.

| | | |
|---|---|---|
| **UNIT 2** | **Sensors** | **06 HOURS** |

**Applications/Case Study:** Home Automation System

**Contents:** Sensor Vs Transducer, Types of sensors: Capacitive Sensors, Resistive sensors, Piezoelectric Sensors, Ultrasonic Sensors, IR sensors.

**Self Study:**Smart Sensors, Scope of Wearable Devices .

| | | |
|---|---|---|
| **UNIT 3** | **Signal Conditioning** | **06 HOURS** |

**Applications/Case Study:** Applications/Case Study: Obstacle Avoiding Robot

**Contents:** Need of Signal Conditioning, Use of OP-Amp in Signal Conditioning, Basics of ADC and DAC

**Self Study:** Study of Wearable Devices

| | | |
|---|---|---|
| **UNIT 4** | **Actuators** | **08 HOURS** |

**Applications/Case Study:** Thermal Relay Actuation

**Contents:** Concept of Actuation, Types of Actuators- A.C. and D.C. Actuators, Relays, Piezoelectric and Piezoresistive actuators, Micro Pumps and Micro actuators.

**Self Study:** Actuation in IOT Applications

| | | |
|---|---|---|
| **UNIT 5** | **Introduction to Microcontroller** | **06 HOURS** |

**Applications/Case Study:** Interfacing of ADC

**Contents:** Concept of Microprocessor and Microcontroller, Selection criteria of Microcontroller, Typical architecture of Microcontroller. Functional overview of Microcontroller, Basic programming with Microcontroller.

**Self Study:** Survey of Different families of Microcontroller

## TEXT BOOKS


1. B. C. Nakra, K.K. Choudhury, *Instrumentation, Measurement and Analysis*,4th Edition, Tata McGraw Publication, Aug 2016. ISBN:9385880624.
2. Jacob Fraden, (2015), *Hand Book of Modern Sensors: physics, Designs and Applications*, 3rd edition, Springer.
3. H.S. Kalsi *Electronic Instrumentation*, 3rd Edition Tata McGraw Hill Publication,2017.ISBN:9780070702066
4. C.S, Rangan, G R Sharma, V S V Mani, *Instrumentation Devices and Systems*, Mc Graw Hill,2017 ISBN:9780074633502


## REFERENCE BOOKS


1. Soumitra Kumar Mandal, (2011), *Microprocessors and Microcontrollers Architecture, Programming & Interfacing Using 8085, 8086 And 8051*, Tata McGraw Hill, India. ISBN:007132920X
2. Jon. S. Wilson, (2005), *Sensor Technology Hand Book*, Elsevier Inc.2005.ISBN:0750677295
3. Murthy, D.V.S., (2003), *Transducers and Instrumentation*, Prentice Hall of India.2020, Second Edition. ISBN:978-8120335691
4. Shawhney A. K., (1999), *A Course In Electrical and Electronics Measurements and Instrumentation*, Dhanpat Rai & Sons, 11th 11th Edition, 1999.ISBN:8177001000
5. Patranabis. D, (2000), *Sensors and Transducers*, Prentice Hall of India. 1999, ISBN:9788120321984
6. John. P, Bentley, (2000), *Principles of Measurement Systems*, 3rd edition, Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: 2026 - 2027 (Rev. 2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (English) Lab |
| | COURSE CODE | 2301111L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : -- | REVISION NO | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301111L.CEO.1: To explain the sounds in English and introduce phonemic transcription.
2301111L.CEO.2: To illustrate the application of fundamental English grammar.
2301111L.CEO.3: To strengthen listening and reading skills with the use of audio and visual aids.
2301111L.CEO.4: To extend the appropriateness of the writing skills in English.
2301111L.CEO.5: To prepare advanced presentations using Canva.
2301111L.CEO.6: To improve communicative competence in English.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301111L.CO.1: Make use of the sounds of English accurately [L3].
2301111L.CO.2: Apply English grammar rules precisely in practical situations [L3].
2301111L.CO.3: Build vocabulary and listening skills using audio-visual aids [L3].
2301111L.CO.4: Develop syntax and texts in English coherently and formally [L3].
2301111L.CO.5: Utilise Canva to improve presentation skills professionally [L3].
2301111L.CO.6: To enhance communicative competence in English [L3].

## COURSE ABSTRACT

The course "Communication Skills: English" primarily focuses on developing communication skills through practical application and utilising language abilities. The objective is to achieve this goal by employing efficient communication and maintaining a constructive demeanour. Students are encouraged to use English as a communication skill to understand speech and body language nuances. This is achieved through activity-based methods and approaches in the language laboratories. The training programme facilitates students' persuasive skills development while fostering improved interpersonal relationships through effective verbal communication. The course enhances students' proficiency and accuracy in communicative competence in English. It enables them to effectively communicate in various contexts, such as society, higher education, and the professional workforce. The course also trains students in using proper practical grammar to enhance effective articulation in English, exploring the primary factors and variables contributing to their difficulties in oral proficiency.

## PRACTICALS

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Pronunciation and Phonemic Transcription** | **4 HOURS** |
| Identification of correct pronunciation of words by decoding phonemic scripts; writing phonemic transcriptions of the given words. | | |
| **PRACTICAL NO.02** | **Tense and Common Errors** | **6 HOURS** |
| Use of tenses in day to day communication and academic writing. | | |
| **PRACTICAL NO.03** | **Listening Skills** | **4 HOURS** |
| Active listening; Conversations, audio and video clips; Listening with comprehension. | | |
| **PRACTICAL NO.04** | **Vocabulory Enrichment** | **4 HOURS** |
| Online exercises on AWL and NAWL using web-based applications; Dictionary Skills and Common errors in grammar while speaking and writing English. | | |
| **PRACTICAL NO.05** | **Resume, Cover Letter and Email Writing** | **4 HOURS** |
| How to write an email, characteristics and essentials of a good email, resume, formal letter writing and layout of business letters . | | |
| **PRACTICAL NO.06** | **Essay Writing** | **4 HOURS** |
| What is an essay? Tips to write a good essay, Types of essays. | | |
| **PRACTICAL NO.07** | **Report Writing** | **4 HOURS** |
| Types of reports, format and writing a report, what is summarizing? Rules of summarizing. | | |

| PRACTICAL NO.08 | Presentation Skills-Canva | 6 HOURS |
|---|---|---|
| Essentials of effective presentations; Data collection and compilation; Preparation of outlines. | | |
| **PRACTICAL NO.09** | **Group Discussions** | **4 HOURS** |
| Concept of GD, Criteria for evaluation, types of GD – General, Creative and Technical, Dos and Don'ts, Guidelines for participation and success, Group Dynamics, Expression of thoughts and ideas, body language and interpersonal and analytical skills. | | |
| **PRACTICAL NO.10** | **Role Play** | **4 HOURS** |
| Role-play for verbal communication, team building and group dynamics, decision making, leadership, analytical and creative thinking, group presentation. | | |
| **PRACTICAL NO.11** | **Debate** | **4 HOURS** |
| Concept, Dos and Don'ts, Guidelines for participation and success, Expression of thoughts and ideas, body language and interpersonal and analytical skills. | | |
| **PRACTICAL NO.12** | **Persuasive Speaking** | **6 HOURS** |
| Attributes of a good public speaker; prepared and extemporaneous speech; Listening and Reading to famous speeches. | | |
| **PRACTICAL NO.13** | **Reading Comprehension** | **6 HOURS** |
| Techniques of reading- Intensive, Extensive, Skimming and Scanning; Reading Comprehensions. | | |

**REFERENCE BOOKS**


1. Ashok Thorat and Munira Lokhandwala: Enriching Oral and Written Communication in English, ISBN 9788125037446.
2. Swan, M. (2005). Practical english usage (Vol. 688). Oxford: Oxford university press.
3. Dutt et.al. : A Course in Communication Skills, Foundation, 1 edition.
4. Peter Roach: English Phonetics and Phonology, 4th Edition, Cambridge, ISBN-0521149215.
5. Lynch: Listening, Cambridge, 1st edition, ISBN- 0521707757.
6. Malcom Goodale: Professional Presentations, Cambridge, ISBN- 8175962577.
7. Aggarwal, S. (2009). Essential communication skills. Ane Books Pvt Ltd.
8. Jennings: Communication Basics, Cengage Learning, 1st edition, ISBN- 8131515206.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2026 - 2027 (Rev. 2023 (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Communication Skills (German) |
| | **COURSE CODE** | 2301112T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301112T.CEO.1: To introduce German language and enhance knowledge, communication and intellectual capabilities.

2301112T.CEO.2: To extend the appropriateness of writing and speaking skills.

2301112T.CEO.3: To develop ability to respond to simple questions in the German language.

2301112T.CEO.4: To acquire basic vocabulary about daily topics.

2301112T.CEO.5: To improve communicative competence in German.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301112T.CO.1: Apply the foundational aspects of grammar and memorize vocabulary [L3].

2301112T.CO.2: Develop comprehension of low to medium difficulty text and practice speaking about every day basic topics [L3].

2301112T.CO.3: Build the basic communication and comprehension skills for conducting day to day business effectively [L3].

2301112T.CO.4: Make use of simple, familiar expressions to interact with native speakers [L3].

2301112T.CO.5: Develop communicative competence in German language [L3].

## COURSE ABSTRACT

The German course not only gives students an excellent grounding in the language, but also opens up fascinating chances to learn more about German culture, history, and literature. Students develop the foundational skills and more advanced strategies necessary to function in a German -speaking culture. A broad variety of linguistic skills, from being able to express oneself properly in writing and speech to being able to understand different forms and talk convincingly in front of an audience of any size, may be honed by learning the language from the bottom up. You may start from scratch with a new language or build on what you already know in this course. Formal education consists of classroom instruction like lectures, seminars, and tutorials. Additionally, students study German through the lens of linked subjects in the fields of history, language, culture, and religion. This German language course is intended for individuals with a high level of linguistic proficiency who want to either deepen their knowledge of the language or begin learning it from scratch.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction and History** | **2 HOURS** |
| **Contents:**Information about Germany, German History, Culture and Language.<br>**Self Study:** Historical perspectives of German language . | | |
| **UNIT 2** | **Greetings and Introduction** | **4 HOURS** |
| **Contents:** Related Vocabulary Alphabets, Numbers, Countries, Languages, Email-Adress, Phone number, Grammar: W-Questions, Simple Sentences, Verb conjugation and personal pronouns like (I, You, He/She/It, We etc.).<br>**Self Study:** Word Formation. | | |
| **UNIT 3** | **Speaking about hobbys, Making an Appointment, Profile in Internet** | **4 HOURS** |
| **Contents:** Numbers (continued), Activity verbs, regular and irregular verbs, Weekdays, Months, Seasons, Professions, Grammar: articles (der, die, das, die) and yes-no-questions.<br>**Self Study:** Oral conversation. | | |
| **UNIT 4** | **City and Sightseeing** | **6 HOURS** |
| **Contents:**Talking about places in a city (railway station, market, bus stop, mall, theatre, cinema hall, museums etc.), Transport (train, bus, plane, tram, metro), Asking for an address or directions, Comprehension: reading city map and events calendar, Grammar: articles in negation (kein, keine, kein, keine), Imperative sentences with you.<br>**Self Study:** Regional information in Germany. | | |
| **UNIT 5** | **Food** | **4 HOURS** |
| **Contents:**Fruits, Vegetables, Drinks, Meals, shops, Grocery shopping, Grammar: Accusative case.<br>**Self Study:** Cultural Food in Germany. | | |

| UNIT 6 | Time | 6 HOURS |
|---|---|---|

**Applications/Case Study:**German Translation.

**Contents:**Talking about time, asking for time, Making an appointment (part 2), Daily routine, Telephone and email conversations, Grammar: Modalverbs, posessive articles (my, your. . . ).

**Self Study:** Time keeping formats.

| UNIT 7 | Revision | 4 HOURS |
|---|---|---|

**Applications/Case Study:** German Translation.

**Contents:** Reading and comprehension, Writing, Listening (optional), Speaking.

## TEXT BOOKS

1. Netzwerk Deutsch als Fremdsprache- Kursbuch A1( Stefanie Dengler), Goyal Publications.

## REFERENCE BOOKS

1. https://www.klett-sprachen.de , https://www.duolingo.com/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2026 - 2027 (Rev. 2023 (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Communication Skills (Japanese) |
| | **COURSE CODE** | 2301113T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301113T.CEO.1: To introduce Japanese as a foreign language and enhance knowledge, communication and intellectual capabilities which helps to improve cognitive skills and creativity vital for problem solving and innovation.

2301113T.CEO.2: To develop an awareness of Japanese culture along with providing better career opportunities later in life.

2301113T.CEO.3: To develop ability to respond to simple questions in the Japanese language.

2301113T.CEO.4: To acquire basic vocabulary about daily topics in Japanese language.

2301113T.CEO.5: To develop skills related to reading simple sentences and understanding uncomplicated dialogues.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301113T.CO.1: Develop communication and comprehension skills for conducting day-to-day business effectively

2301113T.CO.2: Understand typical every day and job-related expressions and sentences in the written format.

2301113T.CO.3: Use simple, familiar expressions and produce main ideas of familiar topics when interacting with native speakers or when visiting Japan.

2301113T.CO.4: Develop basic terminology regarding everyday themes in Japanese.

2301113T.CO.5: Hone abilities in reading easy-to-follow words and comprehending straightforward conversations.

## COURSE ABSTRACT

Learning Japanese gives students a firm grasps of the language as well as a window into Japanese society, history, and literature. Students acquire both the basic and advanced skills necessary to function effectively in a Japanese-speaking culture. Starting from scratch with a language is the best way to develop fluency in all aspects of communication, from reading and writing to speaking in front of large groups with ease. The course is designed to help students learn a new language and improve their existing skills. To acquire knowledge, students participate in classroom activities such as lectures, seminars, and tutorials. In addition, they study Japan and its culture from a variety of angles, including its history, language, culture, and religion. This course is intended with a high level of linguistic proficiency who wants to either expand their knowledge of Japanese or begin learning it from scratch.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction** | **3 HOURS** |
| **Contents:** Information about Japan, Japanese History, Culture and Language.<br>**Self Study:** Japanese Background . | | |
| **UNIT 2** | **Greetings, Self Introduction, Japanese Script** | **6 HOURS** |
| **Contents:**Self-Introduction- Jikoshoukai, Greeting Words, Hiragana Series, Simple vocabulary in Hiragana.<br>**Self Study:**Introduce yourself. | | |
| **UNIT 3** | **Understanding Japanese Script** | **4 HOURS** |
| **Contents:** Katakana Series, Simple vocabulary in Katakana, Introduction of the concept of time .<br>**Self Study:** Japanese script. | | |
| **UNIT 4** | **Understanding Simple Sentence Patterns, Time, Prices, Adjectives** | **5 HOURS** |
| **Contents:** Basic sentence pattern, Use of demonstrative pronouns, Numbers, Expressing time, Asking for / telling prices, Adjectives.<br>**Self Study:** Grammatical Components. | | |
| **UNIT 5** | **Date, Verbs, Directions, Binding Sentences** | **6 HOURS** |
| **Contents:** Dates, time, frequencies, Verbs in the present and past tense, Coming/Going to, Binding and building longer sentences.<br>**Self Study:** Binding sentences. | | |
| **UNIT 6** | **Amounts of Time/Money, Distance, Describing Existence, Counters** | **6 HOURS** |
| **Applications/Case Study:**German Translation.<br>**Contents:**Asking/Telling the amount of time and money, Going from/to, Describing the existence/non-existence of something, Counters.<br>**Self Study:** Describing existence. | | |

**REFERENCE BOOKS**


1. Introduction to Nihongo- Haru 1- Maharashtra State Bureau of Textbook Production and Curriculum Research.
2. Minna No Nihongo-1-1 Japan Foundation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2026 - 2027 (Rev. 2023 (NEP)) |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Communication Skills (French) |
| | **COURSE CODE** | 2301114T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 0.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301114T.CEO.1: To introduce French language and enhance knowledge, communication and intellectual capabilities.

2301114T.CEO.2: To extend the appropriateness of writing and speaking skills.

2301114T.CEO.3: To develop ability to respond to simple questions in the French language.

2301114T.CEO.4: To acquire basic vocabulary about daily topics

2301114T.CEO.5: To improve communicative competence in French.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301114T.CO.1: Apply the foundational aspects of grammar and memorize vocabulary [L3].

2301114T.CO.2: Develop comprehension of low to medium difficulty text and practice speaking about every day basic topics [L3].

2301114T.CO.3: Build the basic communication and comprehension skills for conducting day-to-day business effectively [L3].

2301114T.CO.4: Make use of simple, familiar expressions to interact with native speakers [L3].

2301114T.CO.5: Develop communicative competence in French language [L3].

## COURSE ABSTRACT

The French course provides students with a solid foundation in the language and opportunities to delve further into a foreign culture, history, and literature. Students learn the fundamentals and advanced techniques they need to succeed in a society where French language is spoken. Learning the language from the ground up helps hone a wide range of linguistic abilities, from expressing yourself clearly in speaking and writing to comprehending various formats to confidently address an audience of any size. The course provides with the option to learn a language from the ground up or to expand on any prior knowledge of the language. Students learn through formal training, lectures, seminars, and tutorials. In addition, they pursue a curriculum in French studies through related themes in historical, linguistic, cultural, religious, and other settings. The French course is designed for students with advanced language abilities to deepen their mastery of a foreign language or begin studying it from scratch.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction** | **5 HOURS** |
| **Contents:** Vous connaissez la France ? - Introduction.<br>**Self Study:** Spoken task -record an audio. | | |
| **UNIT 2** | **Presentation and Questioning** | **5 HOURS** |
| **Contents:** Autour de moi- Presenting and questioning Nouns.<br>**Self Study:** Written task- forming questions and exercises. | | |
| **UNIT 3** | **Syntax** | **5 HOURS** |
| **Contents:** Le monde- Sentence structure, talking about oneself, countries, cities ,etc.<br>**Self Study:** Written task- form sentences about oneself, countries, cities ,etc. | | |
| **UNIT 4** | **Speaking and Writing Skills** | **5 HOURS** |
| **Contents:**Ma famille- writing and talking about :Family, house and time.<br>**Self Study:** Written task- form sentences about one's family and house. | | |
| **UNIT 5** | **Writing Task** | **5 HOURS** |
| **Contents:** Mes loisirs- writing and talking about :Hobbies.<br>**Self Study:** Written task- form sentences using different verbs and talk about one's hobbies. | | |
| **UNIT 6** | **Spoken and Written Daily Routine** | **5 HOURS** |
| **Contents:** Ma routine- writing and talking about : daily activities, seasons and one's body.<br>**Self Study:** Written task- form sentences about one's daily routine and seasons. | | |

## TEXT BOOKS

1. Saison 1(unit 1-6)- Didier.

## REFERENCE BOOKS

1. Extracts from: Alter Ego 1, En Echanges, Entre jeunes, Apprenons le franc¸ais.
2. Worksheets.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING | W.E.F | AY: 2026 - 2027 (Rev. 2023 (NEP)) |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Creative Technologies Lab |
| | COURSE CODE | 2307183L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : -- | REVISION NO. | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2307183L.CEO.1: Develop insight for Futuristic Technology Development.
2307183L.CEO.2: Become familiar with Digital Technologies like AI, AR, Block chain, Cloud, IOT
2307183L.CEO.3: Explore various developments in Robotics, EV, Drone and AE/CE, ZEB.
2307183L.CEO.4: Build a solution for real life problem based on futuristic technologies
2307183L.CEO.5: Design and Develop a Digital Portfolio using Web Technology

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2307183L.CO.1: Articulate the significance of United Nations Organization (UNO) Goals. [L2]
2307183L.CO.2: Develop a Digital Portfolio using Web Technology. [L3]
2307183L.CO.3: Illustrate the use cases of emerging technologies. [L2]
2307183L.CO.4: Develop a Laboratory project based on future technologies in a team. [L3]

## COURSE ABSTRACT

This is compulsory course with choice-based modules aims to focus on introduction to the futuristic developing engineering technologies. The students will gain insight to technology development and multidisciplinary industrial environment at introductory level. The students will comprehend different technologies in instructional interaction. They will develop Digital portfolio using Web Technology. The students will have ample choice to select futuristic technology of their interest. In order to experience joyful learning, students will apply chosen futuristic technology for real life problems. Alongside demonstrations and there will be hands on training on chosen futuristic technology. They will develop a laboratory project based on futuristic technologies Like Artificial Intelligence (AI), Generative AI (GenAI) and Prompt Engineering, Block-chain Technology, Electric Vehicles (EV), Internet of Things (IOT), Cloud Computing, Augmented Reality (AR), Robotics and Drones, Zero Energy Building (ZEB) and Affordable and Clean Energy (AE/CE).

## PRACTICALS:

**Module 1: INSTRUCTIONAL MODULE (16 HOURS) [COMPULSORY]**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Sustainable Technology Development** | **1 HOURS** |

Need for Technology, Overview of Technology Development. Advanced Technologies by year 2030, UNO Goals, Priorities, Open problems, Sustainable Technology.

**Application/Case Study:** Zero Hunger (UNO Goals: Sustainable Development Goal 2).

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Digital Portfolio** | **1 HOURS** |

Significance of digital portfolio, Methods for making effective digital portfolio.

**Application/Case Study:** Sample Digital portfolios of students and Professionals.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Futuristic Technologies** | **7 HOURS** |

Introduction to Artificial Intelligence & Machine Learning, Generative AI, Prompt Engineering, Types of Learnings. Basics of Big Data, significance of it. Introduction to Internet of things, IoT overview, Concept of Edge Computing, IOT Edge computing solutions. Need and importance of Cyber Security, Aspects of cyber-Security.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Overview of Emerging technologies** | **7 HOURS** |

Digital Technology Domain: Introduction to Block-chain technology, Fundamental concepts of Cloud computing, Concept of Augmented Reality and applications.

Industry Automation Domain: Introduction to Robotics and Automation, Robot classification, Robot anatomy, Introduction to Drone, Anatomy of a Customized Drone Technology.

Renewable Energy Domain: Solar, Wind, Biofuels, Energy types of fuel cell. Electrical Vehicle (EV), Overview of different systems in EV, Types, Concept of Zero Energy Building (ZEB), Comparison ZEB and Green building, Net zero site energy use, Net zero site source energy use, Net zero energy emissions, Net zero cost Application

| Module 2: WEB TECHNOLOGY MODULE (14 HOURS) [COMPULSORY] | | |
|---|---|---|
| **PRACTICAL NO.01** | **Basic HTML** | **4 HOURS** |
| Web 1.0, 2.0, 3.0, 4.0, Basic html tags, formatting tags, color tags, Div and span tags , Ordered list, Unordered list, Image tags, URL tag, table , Form, Hyperlinks. | | |
| **PRACTICAL NO.02** | **Cascading Style Sheets-CSS** | **4 HOURS** |
| Cascading Style Sheets-CSS, Multiple style sheets, Web page Layout and website Designs. | | |
| **PRACTICAL NO.03** | **Digital Portfolio** | **6 HOURS** |
| One-page/multi-page portfolio using HTML, Projection of information, Personal information, Projects, Achievements, Contact details etc. | | |

| Module-3 ADVANCED TECHNOLOGY MODULE* (16 HOURS) [CHOICE BASED] | | |
|---|---|---|
| * Student will select any one module out of Elevan | | |
| **MODULE NO.3A** | **Artificial Intelligence (AI)** | **16 HOURS** |
| PRACTICAL-1 | Introduction to AI | 02 HOURS |
| PRACTICAL-2 | Image Processing-Object Recognition | 04 HOURS |
| PRACTICAL-3 | Machine Learning- Classification/Prediction | 04 HOURS |
| LAB PROJECT | Lab Project based on AI Application | 06 HOURS |
| **MODULE NO.3B** | **Prompt Engineering for Generative AI** | **16 HOURS** |
| PRACTICAL-1 | Introduction to Generative AI & Prompt Engineering (Basic prompting to Build Generative AI Application) | 02 HOURS |
| PRACTICAL-2 | Designing Prompts for Different Tasks, Prompt Engineering Techniques - N-Shot, Zero Shot and Few Shot Prompting | 04 HOURS |
| PRACTICAL-3 | Content Generation with Prompts (Strategies for generating text, image using prompt) | 04 HOURS |
| LAB PROJECT | Lab Project based on Prompt Engineering for real world prob-lems | 06 HOURS |
| **MODULE NO.3C** | **Block Chain Technology** | **16 HOURS** |
| PRACTICAL-1 | Introduction to Block Chain | 02 HOURS |
| PRACTICAL-2 | Development and Deployment of smart contact | 04 HOURS |
| PRACTICAL-3 | Creation of contact users | 04 HOURS |
| LAB PROJECT | Lab Project based on Block Chain Technology | 06 HOURS |

| MODULE NO.3D | Cloud Computing | 16 HOURS |
|---|---|---|
| PRACTICAL-1 | Creation of AWS account, Service models | 02 HOURS |
| PRACTICAL-2 | Deployment and configuration management | 04 HOURS |
| PRACTICAL-3 | AWS instance on AWS cloud, Deployment of web server | 04 HOURS |
| LAB PROJECT | Lab Project based on Cloud Computing Technology | 06 HOURS |
| **MODULE NO.3E** | **Augmented Reality** | **16 HOURS** |
| PRACTICAL-1 | Introduction to Augmented Reality | 02 HOURS |
| PRACTICAL-2 | Objects, Physics, Light intensity adjustments, Scripts | 04 HOURS |
| PRACTICAL-3 | Development of 3D project and building application | 04 HOURS |
| LAB PROJECT | Lab Project based for Augmented Reality | 06 HOURS |
| **MODULE NO.3F** | **Internet of Things (IOT)** | **16 HOURS** |
| PRACTICAL-1 | Hardware and Software Simulation Environment, Sensor and Actuators | 02 HOURS |
| PRACTICAL-2 | Switch Networking with WiFi module | 04 HOURS |
| PRACTICAL-3 | IoT, Cloud Platforms for IOT | 04 HOURS |
| LAB PROJECT | Lab Project based on IOT | 06 HOURS |
| **MODULE NO.3G** | **Robotics** | **16 HOURS** |
| PRACTICAL-1 | Introduction Components, types components | 02 HOURS |
| PRACTICAL-2 | Sensors, Actuators, Controller and Circuit | 04 HOURS |
| PRACTICAL-3 | Block code | 04 HOURS |
| LAB PROJECT | Lab Project based Robotics | 06 HOURS |

| MODULE NO.3H | Drone Technology | 16 HOURS |
|---|---|---|
| PRACTICAL-1 | Battery, Motors, BLDC, Power rating, losses | 02 HOURS |
| PRACTICAL-2 | Flight controllers, Pixhawk, Mamba Controllers | 04 HOURS |
| PRACTICAL-3 | Propellers, Assembly | 04 HOURS |
| PROJECT | Lab Project based on Drone Applications | 06 HOURS |
| **MODULE NO.3I** | **Affordable and Clean Energy** | **16 HOURS** |
| PRACTICAL-1 | Proton Exchange Membrane Fuel cell | 02 HOURS |
| PRACTICAL-2 | Microbial Fuel cell | 04 HOURS |
| PRACTICAL-3 | Open air cathode type fuel cell for car | 04 HOURS |
| LAB PROJECT | Lab Project for Affordable and Clean Energy | 06 HOURS |

| MODULE NO.3J | Electric Vehicles | 16 HOURS |
|---|---|---|
| PRACTICAL-1 | EV Motors and controllers, Battery pack | 02 HOURS |
| PRACTICAL-2 | Assembly and Working of Two-Wheeler EV | 04 HOURS |
| PRACTICAL-3 | Field Visit to Charging Station | 04 HOURS |
| LAB PROJECT | Lab Project for Electric vehicles | 06 HOURS |
| **MODULE NO.3K** | **Zero Energy Building** | **16 HOURS** |
| PRACTICAL-1 | Calculation of Carbon Footprint, Greenness | 02 HOURS |
| PRACTICAL-2 | Calculation of Electricity bill of Family / Hostel/ College Buildings | 04 HOURS |
| PRACTICAL-3 | Build It Green (PPT/ Video Presentation) | 04 HOURS |
| LAB PROJECT | Model Making | 06 HOURS |

**Continuous Assessment (CA) (35 Marks)**

1. Activity on Sustainability (05 Marks)
2. Activity on Uno goals (10 Marks)
3. *Certification with Online/Offline/Hybrid Course on Future Skills or Future Technologies (20 Marks)

***Certifications [Compulsory for every student]**

1. An Industrial or Academic certification course from Industries Agencies of repute will award 20 Marks.
2. The applicable Certification courses will be announced before the start of semester. The students must register for these courses and complete within the time frame announced.
3. The Institute is having collaborations with different agencies like NASSCOM, IBM, IUCEE etc. The applicable courses will be informed to the students.

**Laboratory Assessment (PR): (40 Marks)**

**Jury (Laboratory Project and Assignment Presentation Exam)**

1. Lab Experiments, Continuous Assessment activities as applicable in respective Modules (10 Marks).
2. Model Making, Poster presentation, Technical Article, Blog, Physical System Development (Basic) etc. activities as applicable in respective Modules (15 Marks).
3. Presentation of Digital portfolio- Presentation of all assignments and activities in the portfolio. (Personal Website). (15 Marks).

**TEXT BOOKS**


1. Solem, J. E. (2012). Programming Computer Vision with Python: Tools and algorithms for analyzing images. " O'Reilly Media, Inc.".
2. Vinod Chandra S.S., Hareendran A. S. (2014) Artificial Intelligence and Machine Learning. Prentice Hall India Learning Private Limited.
3. Hoff, T. (2017) Explain the cloud like I'm 10: Learn the inner-secrets behind Kindle, Netflix, AWS, Apple, Facebook, and Google. United States: Possibility Outpost Inc.
4. Garren A. (2017). AWS: A Beginner's Guide to the Basics of Amazon Webservice.
5. Soni, V. (2022). IOT for beginners: Explore IOT architecture, working principles, IOT devices, and various real IOT projects. Inde (BPB Publications).
6. Ford, M. (2016). Rise of the robots: Technology and the threat of a jobless future. Basic Books.
7. Yasodharan R. (2016). Basics of Robotics: To know all about Robotics. (Online).
8. Davies, B. (2016). In Build a drone: A step-by-step guide to designing, constructing, and flying your very own drone. essay, Skyhorse Publishing.
9. Abell, T. (2017). All about drones (Cutting-Edge Technology). North Star Editions.
10. Sandvik, K. B., & amp; Jumbert, M. G. (2016). The good drone (Emerging Technologies, Ethics and International Affairs). Routledge.
11. Liljequist, B., McLennan, F. (2016). The power of Zero: Learning from the world's leading Net Zero Energy Buildings. Ecotone Publishing.
12. Liu H. (2006). Principles of Fuel Cells. Taylor & Francis.
13. Patel N. (Editor). (2021). Electric Vehicles: Modern Technologies and Trends. Springer.
14. Miles M. (2022). The future in AR (augmented reality) for beginners. Online.

## REFERENCE BOOKS


1. UNITED NATIONS. (2021). Technology and innovation report 2021: Catching technological waves . United Nations Publications. https://unctad.org/system/files/official-document/tir2020_en.pdf.
2. Burrows, M. (2012). Global trends 2030: Alternative worlds. US National Intelligence Council. https://www.dni.gov/files/documents/GlobalTrends_2030.pdf.
3. Open-source reference examples of digital portfolio.
   https://github.com/smaranjitghose/awesome-portfolio-websites
   https://www.freecodecamp.org/news/how-to-build-a-developer-portfolio-website/

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# Second Year

# Bachelor of Technology

# E&TC Engineering

## NEP REVISION 2023 (2.0)

(With Effect from Academic Year: 2027-2028)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2027-2028 |
| SECOND YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

| SEMESTER: III | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2307217T | Electronics Circuits and Applications | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2307217L | Electronics Circuits and Applications Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| PCC | 2307218T | Digital Systems Design | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2307218L | Digital Systems Design Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| PCC | 2307219T | Engineering Electromagnetics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | 2307219U | Engineering Electromagnetics Tutorial | - | - | 1 | - | - | - | - | 25 | 25 | 1 | |
| VSEC | 2307261L | Problem Solving Using OOP(C++) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| | 2307262L | Problem-Solving Using OOP (Java) | | | | | | | | | | | |
| | 2307264/5L | Discipline Skill Development Course | | | | | | | | | | | |
| HSSM VEC | 2301287 | Universal Human Values-II | 1 | 4 | - | - | - | 25 | - | 75 | 100 | 3 | |
| OE | 23BD251L | Prototyping | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| OE | 2301255T | Applied Mathematics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2301255L | Applied Mathematics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ELC PRJ | 2307291L | Project Design | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| TOTAL | | | 11 | 20 | 1 | | | | | | 825 | 22 | |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2027-2028 |
| SECOND YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

| SEMESTER: IV | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2307220T | ARM based Embedded System Design | 3 | - | - | 30 | 20 | 50 | - | - | 100 | | 3 |
| | 2307220L | ARM based Embedded System Design Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| PCC | 2307221T | Principles of Communication Systems | 2 | - | - | 15 | 20 | 40 | - | - | 75 | | 2 |
| | 2307221L | Principles of Communication Systems lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| PCC | 2307222T | Circuit Theory | 2 | - | - | 15 | 20 | 40 | - | - | 75 | | 2 |
| | 2307222U | Circuit Theory Tutorial | - | - | 1 | - | - | - | - | 25 | 25 | | 1 |
| VSEC | 2307263L | Data Structures | - | 4 | - | - | - | - | 35 | 40 | 75 | | 2 |
| MDM | *MDM List | MDM Course-I | 2 | - | - | 15 | 20 | 40 | - | - | 75 | | 2 |
| | *MDM List | MDM Course-I Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| HSSM MEC | 2301276 | Entrepreneurship Skills | 1 | 2 | - | - | - | 25 | 20 | 30 | 75 | | 2 |
| HSSM VEC | 2301286T | Environmental Science | 2 | - | - | 35 | - | 40 | - | - | 75 | | 2 |
| ELC PRJ | 2307292L | Project Implementation | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| ELC SI | 2307296L | Internship (Life And Soft Skills) | - | - | - | - | - | - | - | 75 | 75 | | 2 |
| **Audit** | 2301281A | Indian Constitution | 1 | - | - | - | - | - | - | - | **Audit** | | |
| **TOTAL** | | | **13** | **14** | **1** | | | | | | **850** | | **22** |

*Two Credit Internships need to be completed after Completion of the Second Year.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP) ) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Electronics Circuits and Applications |
| | **COURSE CODE** | 2307217T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2307217T.CEO.1: To Interpret the operation and characteristics of semiconductor devices.
2307217T.CEO.2: To study the designing of analog electronic circuits like amplifiers and oscillators using discrete and integrated components.
2307217T.CEO.3: To comprehend frequency response, feedback and stability of an amplifier.
2307217T.CEO.4: To comprehend and apply the principles of operational amplifiers (OP-AMPS) in both linear and non-linear circuits.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307217T.CO.1: Explain characteristics and working principle of diode , BJT and MOSFET [L2].
2307217T.CO.2: Design of analog electronic circuits, including amplifiers and oscillators, using discrete and integrated components. [L3].
2307217T.CO.3: Analyze DC performance parameters of BJT and MOSFET Circuits [L4].
2307217T.CO.4: Illustrate the feedback mechanism in the designing of electronic circuits [L2].
2307217T.CO.5: Design of linear and non-linear circuit configurations utilizing operational amplifiers (OP-AMPS) [L3].

## COURSE ABSTRACT:

Electronics Circuits and Applications is an essential foundational course for students studying Electronics and Telecommunication Engineering. This course provides a thorough and understandable overview of the design and use of a variety of analog electronic circuits.The course covers the operation of semiconductor devices, the design of analog electronic circuits and their applications.The course also explores operational amplifiers (OP-AMPs) in both linear and non-linear applications, as well as the design and operation of various oscillators.Students will learn to analyze and design single-stage and multistage transistor amplifiers, including their frequency response and feedback effects. By the end of the course, students will have a solid foundation in analog electronics, preparing them for advanced study and practical applications in the field.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Semiconductor Devices** | **06 HOURS** |

**Applications/Case Study:** Design of Power Supply circuit

**Contents:** Applications of different types Diodes (clipper clamper, voltage regulator), Construction and operation of BJT, input and output characteristics of BJT. Introduction to MOSFETs, Construction and operation of n-channel MOSFET.

**Further Readings/Self Study:** LDR , Photodiode

| | | |
|---|---|---|
| **UNIT 2** | **BJT - Applications and Analysis** | **06 HOURS** |

**Applications/Case Study:** Design of a Low-Noise BJT Preamplifier for Biomedical Applications

**Contents:** Single stage Transistor amplifiers: Common base, common emitter, common collector,Frequency response of amplifiers, Small signal Model of BJT and DC Analysis , Multiple stage amplifiers: Cascade configuration ,CE-CC, CC-CC, Darlington configuration

**Further Readings/Self Study:** Thermal runaway and Thermal stability of BJT

| | | |
|---|---|---|
| **UNIT 3** | **MOSFET - Applications and Analysis** | **08 HOURS** |

**Applications/Case Study:** Study of RF Power Amplifier used in communication system

**Contents:** Common source circuit, Load Line and Modes of operation, common MOSFET configurations: DC Analysis, constant current source biasing, Frequency response for amplifier, MOSFET capacitance, Classification of power amplifiers, analysis of class-A , class-B and push- pull amplifiers

**Further Readings/Self Study:** MOSFET electrical parameters, CMOS

| | | |
|---|---|---|
| **UNIT 4** | **Feedback Amplifiers and Oscillators** | **08 HOURS** |

**Applications/Case Study:** Clock Generation in Microprocessors and Communication Systems

**Contents:** Feedback: Basic concepts of feedback, Analysis of the effects of feedback on gain , bandwidth, and stability .Oscillators: Basic principle of sinusoidal oscillation, RC Oscillators, LC Oscillators ,Crystal oscillators, Voltage Controlled Oscillators, operation and components Phase lock loop (PLL)

**Further Readings/Self Study:** Feedback Typologies

| UNIT 5 | Linear Applications of OP-AMP | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Microphone Mixer using operational amplifiers

**Contents:** Inverting and Non-inverting amplifier, voltage follower, ideal and practical integrator, ideal and practical integrator Differentiator, Isolation amplifier, Requirements of Instrumentation amplifier,3 OP-AMP Instrumentation amplifiers, OP-AMP Integrator as ADC.

**Further Readings/Self Study:** Design of strain gauge , Thermocouple

| UNIT 6 | Non Linear Applications of OP-AMP | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Analog to digital Converter Circuit

**Contents:** Comparators, Applications of Comparator, Schmitt Trigger(symmetrical/asymmetrical), Need of precision rectifier, Half wave, Full wave precision rectifiers, Square wave and Triangular wave generator, Sample and hold circuit, peak detectors, Converters using OP-AMP.

**Further Readings/Self Study:** Design of comparative circuit for different applications

## TEXT BOOKS


1. Neamen, (2007). *Electronic Circuit Analysis and Design*. 3rd Edition,Tata McGraw Hill Publishers. ISBN 9780070634336.
2. Franco, S. (2014). *Design with Operational Amplifiers and Analog Integrated Circuits*. 4th Edition, McGraw-Hill Professional. ISBN 9780078028168.


## REFERENCE BOOKS


1. Millman, J. (2010). *Integrated Electronics- Analog and Digital Circuits and Systems*. 2nd Edition, Tata McGraw-Hill Education. ISBN 9780070151420.
2. Boylestad, R. L., and Nashelsky, L. (2013). *Electronic Devices & Circuit theory*. 11th Edition, Pearson New International. ISBN 9780133109047.
3. David A. Bell, (2003). *Operational Amplifiers and Linear ICs,*. 2nd Edition, Prentice Hall of India. ISBN : 81203235994.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Electronics Circuits and Applications Lab |
| | **COURSE CODE** | 2307217L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307217L.CEO.1: To develop proficiency in constructing and troubleshooting analog electronic circuits comprised of semiconductor devices and operational amplifiers.

2307217L.CEO.2: To enhance skills in analyzing and evaluating the performance of analog electronic circuits across diverse practical scenarios

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307217L.CO.1: Construct the analog electronic circuits using semiconductor devices and operational amplifiers [L3].

2307217L.CO.2: Troubleshoot analog electronic circuits comprised of semiconductor devices and operational amplifiers [L4].

2307217L.CO.3: Analyse the performance of analog electronic circuits in various practical scenarios [L4].

**COURSE ABSTRACT:**

The Electronics Circuits and Applications Laboratory offers students the opportunity to translate theoretical knowledge into practical skills through hands-on experimentation with analog electronic circuits. This laboratory complements the concepts learned in the corresponding theory course by providing practical experience in constructing, analyzing, and troubleshooting various analog circuits. Students will work with semiconductor devices and operational amplifiers to design and analyse circuits commonly used in electronics applications.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Limiter circuits in FM transmitter circuit** | **4 HOURS** |
| Implementation of different types of clipper circuits used in FM transmitters | | |
| **PRACTICAL NO.02** | **Small signal amplifier for Public Address (PA) system** | **2 HOURS** |
| Implementation of single stage CE amplifier used as Small signal amplifier for Public Address (PA) system | | |
| **PRACTICAL NO.03** | **Frequency response of the Multistage amplifier** | **2 HOURS** |
| Implementation of two stage CE amplifier and analysis of gain and frequency response | | |
| **PRACTICAL NO.04** | **Tuned circuit in FM transceiver** | **4 HOURS** |
| Implementation of LC and RC phase shift Oscillators used as tuned circuit in FM transceiver | | |
| **PRACTICAL NO.05** | **Low Pass and High Pass filter using OP-AMP** | **4 HOURS** |
| Implementation of practical Integrator and practical Differentiator circuits using OP-AMP | | |
| **PRACTICAL NO.06** | **Waveform Generator** | **4 HOURS** |
| Implementation of Square/Triangular waveform generator circuit using OP-AMP | | |
| **PRACTICAL NO.07** | **Precision Rectification in peak detector circuit** | **2 HOURS** |
| Implementation of Half wave Precision Rectification used in peak detector circuit | | |
| **PRACTICAL NO.08** | **Level detector using OP-AMP** | **2 HOURS** |
| Implementation of OP-AMP Schmitt trigger circuit used as Level detector | | |

**TEXT BOOKS**


1. Neamen, (2007). *Electronic Circuit Analysis and Design*. 3rd Edition,Tata McGraw Hill Publishers. ISBN 9780070634336.
2. Franco, S. (2014). *Design with Operational Amplifiers and Analog Integrated Circuits*. 4th Edition, McGraw-Hill Professional. ISBN 9780078028168.

**REFERENCE BOOKS**


1. Millman, J. (2010). *Integrated Electronics- Analog and Digital Circuits and Systems*. 2nd Edition, Tata McGraw-Hill Education. ISBN 9780070151420.
2. Boylestad, R. L., and Nashelsky, L. (2013). *Electronic Devices & Circuit theory*. 11th Edition, Pearson New International. ISBN 9780133109047.
3. David A. Bell, (2003). *Operational Amplifiers and Linear ICs,*. 2nd Edition, Prentice Hall of India. ISBN : 81203235994.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP) ) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Digital Systems Design |
| | **COURSE CODE** | 2307218T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307218T.CEO.1: Explore the design and analysis of combinational and sequential digital design
2307218T.CEO.2: To explore HDL concepts and constructs to the students.
2307218T.CEO.3: To acquaint students about synthesis coding style of building sophisticated designs and test-benches using HDL language.
2307218T.CEO.4: To describe the structure of some typical programmable logic devices.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307218T.CO.1: Analyse and synthesise combinational logic circuits and sequential Logic circuits [L4].
2307218T.CO.2: Interpret combinational and sequential logic with Hardware Description Language [L3].
2307218T.CO.3: Device Finite State Machines for specific applications [L4].

**COURSE ABSTRACT:**

The course is designed to be one of the first undertaken by new students in electrical electronics and EnTC engineering such that its successful completion will provide the necessary foundation for more specialist learning in Digital Microelectronics and Embedded sytems Design.

The course takes the student from the fundamentals of digital logic to the actual design of a processor. By the end of this course, students will be able to have a top-to-bottom understanding of how the integrated Digital design works.

The lab component will be full of practical experience with, tools, and techniques for modeling complex digital systems. With the Verilog hardware description language, using modern computer aided design (CAD) software to design, simulate, and lay out of the digital circuits will be experienced.

Learning opportunities include: online presentations with integrated practice exercises; tutorials in which small teams work together to explore, discuss, analyze and explain digital electronic circuits; and practicals in which theory is put to useful application.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Digital Design: The Go through** | **08 HOURS** |

**Applications/Case Study:** Automatic Alarm Circuit

**Contents:** Need, Scope, journey of Digital Design, Introduction to digital logic, Combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps
Introduction to PLDs like PAL, PLA, Implementation of combinational logics using PLDs

**Further Readings/Self Study:** CMOS logic family

| | | |
|---|---|---|
| **UNIT 2** | **Combinational Circuit Design : Data flow approach** | **08 HOURS** |

**Applications/Case Study:** BCD Error Detection and Correction

**Contents:** Design flow, Hardware Description Languages, Levels of abstraction, Design Methodology: Top Down, Bottom Up, Elements of HDL, Introduction to modeling styles, Data flow modeling: Concurrent statements, The design of Half adder, Full adder, BCD adder, Code converters, Magnitude comparator, Multiplexers and Decoders

**Further Readings/Self Study:** Simulation of application of BCD to Gray code converter

| | | |
|---|---|---|
| **UNIT 3** | **Combinational and Sequential Design : The structural and behavioural approach** | **08 HOURS** |

**Applications/Case Study:** Flip-Flop as a Bounce Elimination Switch

**Contents:** The combinational and sequential circuits differentiation, Introduction to Flip flops, Design of Counters and Shift registers; Introduction to Behavioural modelling and Structural modelling ;
Design of Decoder, Encoder, Multiplexer with behavioural and Structural approach ; Design of Flip Flops, Ripple and Synchronous Counters, Shift Registers, Implementation of sequential logic with behavioural and Structural approach.

**Further Readings/Self Study:** 4 bit ALU design, RAM, ROM design

| UNIT 4 | FSM Design and Implementation | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Operation and Study of Washing Machine

**Contents:** HDL based implementation of FSM using Synchronous or clocked sequential circuits, Clock skew, Delay models; Moore circuit, Melay circuits: Basic design steps, State diagram, State table, State reduction, State assignment, State assignment problem, Design with unused states, Lockout condition, State encoding techniques, Sequence generator, Sequence detector, Analysis of sequential circuits.

**Further Readings/Self Study:** Serial Adder

## TEXT BOOKS


1. Ronald Tocci, et.al (2016) Digital Systems: Principles and Applications. 12th Edition 1292162007, 978-1292162003
2. Harris, S., & Harris, D. (2021). Digital Design and Computer Architecture: RISC-V Edition. Morgan Kaufmann. ISBN 978-0128200643
3. Brown, S. D., & Vranesic, Z. G. (2008). Fundamentals of Digital Logic with Verilog Design. McGraw-Hill Science, Engineering Mathematics.ISBN 978-0073380339
4. Mano, M. M., & Ciletti, M. D. (2013). Digital Design: With an Introduction to the Verilog HDL. Pearson Academic. ISBN 13: 9780137501984
5. Stallings, W. (2010). Computer Organization and Architecture: Designing for Performance. Prentice Hall.ISBN:978-0136073734


## REFERENCE BOOKS


1. Wakerly, J. F. (1990). Digital Design: Principles and Practices. ISBN 0132128381, 978-0132128384
2. Tokheim, R. L. (1999). Digital Electronics: Principles and Applications.ISBN 007116796X, 978-0071167963
3. Douglas Perry (2012). VHDL: programming by examples. 4th Edition. Tata McGraw Hill, ISBN: 978-0070499447
4. Gothman William (1982). Digital Electronics-An introduction to theory and practice, Prentice Hall India Learning Private Limited; 2nd edition, ISBN: 978- 8120303485.
5. Ashenden Peter J.(2007). Digital Design An embedded System Approach using VHDL. Morgan Kaufmann Publishers, ISBN: 978-813121663-7.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Digital Systems Design Lab |
| | **COURSE CODE** | 2307218L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307218L.CEO.1: Explore the design and analysis of combinational and sequential digital design

2307218L.CEO.2: To explore HDL concepts and constructs to the students.

2307218L.CEO.3: To acquaint students about synthesis coding style of building sophisticated designs and test-benches using HDL language.

2307218L.CEO.4: To describe the structure of some typical programmable logic devices.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307218L.CO.1: Implement combinational circuits on hardware using logic gates ICs [L3].

2307218L.CO.2: Analyze a synthesizable circuit for combinational and sequential logic using Hardware Description language [L4].

2307218L.CO.3: Validate Finite State Machines using Hardware Description Language [L5].

**COURSE ABSTRACT:**

The course is designed to be one of the first undertaken by new students in electrical, electronics and EnTC engineering such that its successful completion will provide the necessary foundation for more specialized learning in Digital Electronics and Embedded systems Design. The course takes the student from the fundamentals of digital logic to the actual design of a processor. By the end of this course, students will be able to have a complete top-to-bottom understanding of how the integrated Digital circuits are designed. The lab component is having full of practical experience with tools and techniques for modeling complex digital systems. With the VHDL hardware description language, using modern computer aided design (CAD) software to design and simulate the digital circuits will be experienced. Learning opportunities include: online presentations with integrated practice exercises; tutorials in which small teams work together to explore, discuss, analyze and explain digital electronic circuits; and practicals in which theory is put to useful application.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Title: Implementation of Boolean Logic Functions using logic gates and combinational circuits.** | **4 HOURS** |

Implementation of Boolean Logic Functions using logic gates and combinational circuits.

a. Identify various gate ICs and their specification.

b. To simplify the given expression and to realize it using Basic gates and Universal gate.

c. To design and implement IC based circuit for the combinational logic e.g. Full Adder/Subtractor.

Tools: IC based design with bread boards, trainer kits and Simulators like Logisim, Spice etc.

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Introduction to Digital Design Flow** | **2 HOURS** |

a. Introduction to tools based on Hardware Description Language (HDL)

b. Design and simulation of examples of basic canonical form equations on ISE

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Design and configure various digital circuits such as Adder/ Subtractor, Code converters** | **4 HOURS** |

Design and configure various digital circuits

a. To write a HDL code to describe the functions of a Full Adder/ Subtractor etc.

b. To design and simulate the HDL code for the code converters.

Tools: IC based design and ISE based simulation

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Design and configure decoder/ encoder, multiplexer/demultiplexer circuits** | **4 HOURS** |

Design and configure Decoder/Encoder, Multiplexer/Demultiplexer circuits

a. To design and simulate the HDL code for the 3 to 8 decoder/8 to 3 encoder or any other MSI logics

b. To design and simulate the HDL code for the 1: 8 multiplexer / 8:1 demultiplexer circuits.

Tools:IC based design and ISE based simulation

Self study with the guidance of mentor: Implementation of theses logics with the help of MSI ICs on bread boards or Trainer kits

| PRACTICAL NO.05 | Design and configure flip-flop, registers and counters. | 4 HOURS |
|---|---|---|

Design and configure Decoder, Encoder, Multiplexer and Demultiplexer circuits

a. To write HDL codes for SR, JK, D, T flip flops and verify its functionality.

b. To write HDL codes for the counters

Tools: ISE based simulation

Self study with the guidance of mentor: Implementation of theses logics with the help of MSI ICs on bread boards or Trainer kits

| PRACTICAL NO.06 | FSM Design | 4 HOURS |
|---|---|---|

To generate and simulate the sequence detector and sequence generator with overlapping/non overlapping patterns.

Tools:The development kits

| PRACTICAL NO.07 | The collaborative task | 4 HOURS |
|---|---|---|

Sample collaborative tasks are:

a. Lift controller

b. Key board scanner

c. Water level controller

d. Traffic light controller

e. Vending machine

f. Digital Alarm clock.

**TEXT BOOKS**


1. Ronald Tocci, et.al (2016) Digital Systems: Principles and Applications. 12th Edition 1292162007, 978-1292162003
2. Harris, S., & Harris, D. (2021). Digital Design and Computer Architecture: RISC-V Edition. Morgan Kaufmann. ISBN 978-0128200643
3. Brown, S. D., & Vranesic, Z. G. (2008). Fundamentals of Digital Logic with Verilog Design. McGraw-Hill Science, Engineering Mathematics.ISBN 978-0073380339
4. Mano, M. M., & Ciletti, M. D. (2013). Digital Design: With an Introduction to the Verilog HDL. Pearson Academic. ISBN 13: 9780137501984
5. Stallings, W. (2010). Computer Organization and Architecture: Designing for Performance. Prentice Hall.ISBN:978-0136073734

## REFERENCE BOOKS


1. Wakerly, J. F. (1990). Digital Design: Principles and Practices. ISBN 0132128381, 978-0132128384
2. Tokheim, R. L. (1999). Digital Electronics: Principles and Applications.ISBN 007116796X, 978-0071167963
3. Douglas Perry (2012). VHDL: programming by examples. 4th Edition. Tata McGraw Hill, ISBN: 978-0070499447
4. Gothman William (1982). Digital Electronics-An introduction to theory and practice, Prentice Hall India Learning Private Limited; 2nd edition, ISBN: 978- 8120303485.
5. Ashenden Peter J.(2007). Digital Design An embedded System Approach using VHDL. Morgan Kaufmann Publishers, ISBN: 978-813121663-7.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP) ) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Engineering Electromagnetics |
| | **COURSE CODE** | 2307219T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307219T.CEO.1: To impart basics of electrostatics and magnetostatics.
2307219T.CEO.2: To lay the foundations of electromagnetism.
2307219T.CEO.3: To introduce the concept of time varying field and Maxwell equation.
2307219T.CEO.4: To provide hands-on of simulation and measurement process.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307219T.CO.1: Apply the principles of static field to solve the problems [L3].
2307219T.CO.2: Analyze the electromagnetic field using Maxwell equations [L4].
2307219T.CO.3: Identify the line parameters in transmission lines [L3].
2307219T.CO.4: Simulate basic antenna designs [L3].

## COURSE ABSTRACT:

Engineering electromagnetics is an application-oriented course covering all the theoretical concepts along with antenna design, fabrication and testing. First, the course covers the topic necessary for understanding the entire course, like a brief review of mathematics (coordinate systems, vector analysis,vector fields, gradient, divergence, and curl), electrostatics and magnetostatics. Further, the advanced topics necessary for understanding electromagnetics applications are covered, including topics like the concept of time-varying field, Maxwell's equation, wave propagation, uniform plane wave, Poynting theorem, Poynting Vector, polarization, the reflection of wave, transmission line and waveguide. To address the software part, this course provides hands-on simulation and measurement processes and familiarization with fabrication processes.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Static Fields** | **06 HOURS** |

**Applications/Case Study:** Physical significance of gradient, divergence and curl (Demonstration on MATLAB)

**Contents:** Fields, Static electric field, Fundamental postulates of electrostatics, Electric flux density, Electrostatic potential, Electric dipole, Static magnetic field, Fundamental postulates of magneto statics, Magnetic flux density, magnetic potential, capacitance,and inductance

**Further Readings/Self Study:** Coulomb's law, Gauss' law, Biot-Savart law, Ampere's circuital law, and field calculation

| | | |
|---|---|---|
| **UNIT 2** | **Maxwells equations and Time-varying fields** | **08 HOURS** |

**Applications/Case Study:** Justification of light as an electromagnetic wave

**Contents:** Introduction of Time-varying fields, faradays law of Electromagnetic induction, Maxwells equations, Electromagnetic wave generation and equationwave parameter, Uniform plane wave, Poynting theorem-Poynting Vector and its significance, polarization and reflection of wave

**Further Readings/Self Study:** Application of Electromagnetics, Frequency bands, polarization and reflection of wave

| | | |
|---|---|---|
| **UNIT 3** | **Transmission line** | **06 HOURS** |

**Applications/Case Study:** Application of Smith Chart in Impedance Matching

**Contents:** Transmission Lines, Equations of voltage and current on Transmission lines, Propagation constant and characteristics impedance, Reflection coefficient and VSWR, Power transfer on Transmission lines, Smith chart

**Further Readings/Self Study:** Health Implications of Electromagnetic Fields and Electromagnetic compatibility (EMC)

| | | |
|---|---|---|
| **UNIT 4** | **Antenna basics and Simulation of basic antennas** | **10 HOURS** |

**Applications/Case Study:** Demonstration of Dipole, and Microstrip Patch Antenna in HFSS

**Contents:** Introduction to waveguide, Analysis of waveguides general approach, Rectangular waveguides, TE & TM modes, Introduction to antenna and antenna parameter , Ansys HFSS desktop introduction,and Steps for the designing of microwave devices and antennas

**Further Readings/Self Study:** Simulation of Horn Antenna in HFSS

## TEXT BOOKS


1. Matthew N. O. Sadiku (2018). *Elements of Electromagnetics*. 7th Edition, Oxford University Press. ISBN 9780190698614.
2. William H. Hayt, John A. Buck, Jaleel M. Akhtar (2020). *Engineering Electromagnetics*. 9th Edition, McGraw Hill Education (India) Private Limited. ISBN- 9789353169725.
3. Constantine A. Balanis (2016). *Antenna Theory: Analysis and Design*. 4th Edition, Wiley. ISBN: 978-1-118-64206-1.
4. Ansoft, H. F. S. S. (2003). *Users GuideHigh Frequency Structure Simulator* Ansoft Co.


## REFERENCE BOOKS


1. R Shevgaonkar. (2017). *Electromagnetic Waves*. 1th Edition, McGraw Hill Education. ISBN-13: 978-0070591165.
2. Karl E. Lonngren, Sava Savov, Randy J. Jost (2012). *Fundamentals of Electromagnetics with MATLAB*. 3rd Edition, SciTech Publishing Inc. ISBN-13: 978-8120337374.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Engineering Electromagnetics Tutorial |
| | **COURSE CODE** | 2307219U |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 1 | NIL | NIL | NIL | NIL | 25 | 25 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307219U.CEO.1: To strengthen the understanding of applying electromagnetic theory concepts to solve practical engineering problems.

2307219U.CEO.2: To develop the understanding of electromagnetic theory in the designing and analysis of different antenna.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307219U.CO.1: Solve problems related to electric fields, magnetic fields, time varying field and transmission line [L3].

2307219U.CO.2: Evaluate the performance of different types of antennas [L5]

**COURSE ABSTRACT:**

This tutorial course in Engineering Electromagnetics is designed to provide students with a thorough understanding of the fundamental principles and applications of electromagnetics in engineering. The course covers essential topics such as electric and magnetic fields, electromagnetic wave propagation, transmission lines, and antenna theory. Through a combination of theoretical lectures, practical problem-solving sessions, and hands-on sessions, students will develop a strong foundation in electromagnetics and its real-world applications in various engineering domains.

| **TUTORIALS** | | |
|---|---|---|
| **TUTORIAL NO.01** | **Basic Concepts and Problems** | **1 HOURS** |
| Problems on vectors, coordinate systems, line, surface & volume integrals | | |
| **TUTORIAL NO.02** | **Problems on vector differential operator** | **1 HOURS** |
| Calculation of gradients, divergence, curl, circulation, and flux crossing | | |
| **TUTORIAL NO.03** | **Static field calculation** | **1 HOURS** |
| Static electric and magnetic field calculations, problems based on electric and magnetic potentials. | | |
| **TUTORIAL NO.04** | **Analysis the time-varying fields-I** | **1 HOURS** |
| Problems on EM wave propagation in different media | | |
| **TUTORIAL NO.05** | **Analysis the time-varying fields-II** | **1 HOURS** |
| Problems on reflection of waves, polarization, and poynting vector | | |
| **TUTORIAL NO.06** | **Transmission line** | **2 HOURS** |
| Calculation of transmission line parameters, problems on input impedance, standing wave ratio, & power, problems on the Smith chart | | |
| **TUTORIAL NO.07** | **Waveguide** | **2 HOURS** |
| Problems based on cutoff frequency, phase constant, propagation constant, and intrinsic wave impedance for rectangular waveguide | | |
| **TUTORIAL NO.08** | **Simulation of basic antenna designs** | **4 HOURS** |
| Simulation of basic antenna design on software | | |

## TEXT BOOKS


1. Matthew N. O. Sadiku (2018). *Elements of Electromagnetics*. 7th Edition, Oxford University Press. ISBN 9780190698614.
2. William H. Hayt, John A. Buck, Jaleel M. Akhtar (2020). *Engineering Electromagnetics*. 9th Edition, McGraw Hill Education (India) Private Limited. ISBN- 9789353169725.
3. Constantine A. Balanis (2016). *Antenna Theory: Analysis and Design*. 4th Edition, Wiley. ISBN: 978-1-118-64206-1.
4. Ansoft, H. F. S. S. (2003). *Users GuideHigh Frequency Structure Simulator* Ansoft Co.


## REFERENCE BOOKS


1. R Shevgaonkar. (2017). *Electromagnetic Waves*. 1th Edition, McGraw Hill Education. ISBN-13: 978-0070591165.
2. Karl E. Lonngren, Sava Savov, Randy J. Jost (2012). *Fundamentals of Electromagnetics with MATLAB*. 3rd Edition, SciTech Publishing Inc. ISBN-13: 978-8120337374.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F.** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING** | **COURSE NAME** | Problem Solving Using Object Oriented Programming (C++) |
| | **COURSE CODE** | 2307261L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 0.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** BASIC COMPUTING KNOWLEDGE

**COURSE OBJECTIVES :**

2307261L.CEO.1: To demonstrate Object Oriented Programming concepts.
2307261L.CEO.2: To illustrate modularity, scalability and code reusability.
2307261L.CEO.3: To identify various perspectives of a problem.
2307261L.CEO.4: To choose the optimal solution for real life problems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307261L.CO.1: Apply the principles of object-oriented programming in data encapsulation, constructors and code optimization using functions [L3].
2307261L.CO.2: Demonstrate inheritance and polymorphism for code reuse and flexibility & exception handling for robust programming [L3].
2307261L.CO.3: Utilize pointers & TYPE CASTING effectively in their programs [L3].
2307261L.CO.4: Apply C++ knowledge to solve a variety of programming problems [L3].

**COURSE ABSTRACT:**

Problem Solving using Object Oriented Programming (C++) is the Skill Development Course. The basic aim of the course is to introduce the students to Object Oriented Programming using C++ and make their concepts clear for designing real time applications using the same. The inclusion of Challenging Problems in the course will enhance students' logical thinking and boost their analytical skills. Various stages in problem solving will help students to deal with complex problems easily. This course will improve students problem solving abilities and coding skills.

**CONTENTS :**

Introduction to C++, Tokens, Data types, Operators, Structure of C++ Programs, Classes and Objects, Constructors, Destructors; Arrays, Expressions and Control Structures, Types of Constructors and Member Functions; Overloading; Reference and Pointers, Dynamic Memory Management; Functions in C++: Argument passing in function, Inline Functions, Default Arguments, Constant Arguments, Friend class, Friend function; Inheritance; Polymorphism; Exception Handling; std::move in utility; Templates; Standard Template Library; Type casting and cast operators.

**Self Study:** Structures, Union

**Further Readings:** File Handling Operations, Multithreading

**OBJECT ORIENTED PROGRAMMING:**

**PRACTICAL:** All assignments should be performed considering real world applications.

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **CLASS AND OBJECTS** | **2 HOURS** |
| Write a program on class, constructor, destructor, and user-defined functions. | | |
| **PRACTICAL NO.02** | **CONSTRUCTOR TYPES** | **2 HOURS** |
| Implement various types of constructors and member functions. | | |
| **PRACTICAL NO.03** | **OPERATOR OVERLOADING** | **2 HOURS** |
| Write a program on operator overloading using default and parameterized constructors. | | |
| **PRACTICAL NO.04** | **DYNAMIC MEMORY** | **4 HOURS** |
| a) Assignment based on references and pointers.<br>b) Write a program on new and delete operators in C++ for dynamic memory. | | |
| **PRACTICAL NO.05** | **FUNCTION TYPES, FRIEND CLASS** | **4 HOURS** |
| Assignment based on class, objects, this pointer, inline function, static member function and friend class. | | |
| **PRACTICAL NO.06** | **INHERITANCE** | **2 HOURS** |
| Implement different types of inheritance. | | |
| **PRACTICAL NO.07** | **POLYMORPHISM** | **2 HOURS** |
| Write a program on polymorphism. | | |

| PRACTICAL NO.08 | EXCEPTION HANDLING | 2 HOURS |
|---|---|---|
| Implement exception handling operations. | | |
| **PRACTICAL NO.09** | **STD::MOVE IN UTILITY** | **2 HOURS** |
| Write a program on std::move in utility. | | |
| **PRACTICAL NO.10** | **TEMPLATES** | **2 HOURS** |
| Implement class template, function template. | | |
| **PRACTICAL NO.11** | **STANDARD TEMPLATE LIBRARY** | **4 HOURS** |
| a) Assignment based on list class as a container of standard template library.<br>b) Assignment based on vector class as a container of standard template library. | | |
| **PRACTICAL NO.12** | **TYPE CASTING** | **2 HOURS** |
| Assignment based on type casting and casting operators. | | |

| PROBLEM SOLVING: | | |
|---|---|---|
| 01 | BASIC PROGRAMMING | 2 HOURS |
| 02 | NUMBER SYSTEM | 2 HOURS |
| 03 | ARRAY | 2 HOURS |
| 04 | MATRIX | 2 HOURS |
| 05 | STRING | 2 HOURS |
| 06 | MATH | 2 HOURS |
| 07 | BIT MANIPULATION | 2 HOURS |
| 08 | SEARCHING AND SORTING | 2 HOURS |
| 09 | INHERITANCE | 2 HOURS |
| 10 | POLYMORPHISM | 2 HOURS |
| 11 | TEMPLATES/COLLECTION | 2 HOURS |
| 12 | MULTITHREADING | 4 HOURS |
| 13 | STACK AND QUEUE (FURTHER PRACTICE) | 2 HOURS |
| 14 | FILE PROCESSING (FURTHER PRACTICE) | 2 HOURS |

## EXAMINATION SCHEME

1. Continuous Assessment: 20 Marks
2. Mid Semester Practical Examination for Problem Solving: 15 Marks
3. End Semester Practical Examination for OOP(C++): 20 Marks
4. End Semester Practical Examination for Problem Solving: 20 Marks

## TEXT BOOKS


1. E. Balgurusawmy. (2020). *Object Oriented Programming with C++*. 8th Edition, McGraw Hill Publishers. ISBN 9389949181.
2. Paul Deitel, Harvey Deitel. (2017). *C++: How to Program*. 10th Edition, Pearson International. ISBN 9789332585737.
3. Sprankle Maureen. (2011). *Problem Solving and Programming Concepts*. 9th Edition, Person. ISBN 978-0132492645.
4. Savitch Walter. (2017). *Problem Solving with C++*. 10th Edition, Person. ISBN 978-0134448282.


## REFERENCE BOOKS


1. Bjarne Stroustroup. (2014). *Programming - Principles and Practice using C++*. 2nd Edition, Addison-Wesley Educational Publishers Inc . ISBN 978-0275967819.
2. Herbtz Schildt. (2017). *C++: The Complete reference*. 4th Edition, McGraw Hill Education. ISBN 978-0070532465.
3. V. Anton Spraul. (2012). *Think Like a Programmer: An Introduction to Creative Problem Solving*. 1st Edition, No Starch Press US. ISBN 978-1593274245.


## E-RESOURCES

1. https://nptel.ac.in/courses/106105151
2. https://nptel.ac.in/courses/106101208

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING** | **COURSE NAME** | Problem Solving Using Object Oriented Programming (JAVA) |
| | **COURSE CODE** | 2307262L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 0.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** FUNDAMENTALS OF COMPUTING

## COURSE OBJECTIVES :

2307262L.CEO.1: To demonstrate Object Oriented Programming concepts.
2307262L.CEO.2: To illustrate modularity, scalability and code reusability.
2307262L.CEO.3: To identify various perspectives of a problem.
2307262L.CEO.4: To choose the optimal solution for real life problems.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307262L.CO.1: Develop solutions for real-world problems using Object Oriented Programming. [L3]
2307262L.CO.2: Choose an appropriate programming solution to reduce complexity. [L5]
2307262L.CO.3: Apply critical thinking and programming skills for problem solving. [L3]
2307262L.CO.4: Utilize logic building traits efficiently for solving real life problems. [L3]

**COURSE ABSTRACT:**

Problem Solving using Object Oriented Programming (JAVA) is the Skill Development Course. The basic aim of the course is to introduce the students to Object Oriented Programming using JAVA. and make their concepts clear for designing real time applications using the same. The inclusion of Challenging Problems in the course will enhance students logical thinking and boost their analytical skills. Various stages in problem solving will help students to deal with complex problems easily. This course will improve students problem solving abilities and coding skills.

**CONTENTS :**

Basics of Java, Data Types and Variables, Operators, Control Statements,Looping, Arrays; String, String Buffer, String Builder; Methods, Lambda Expression, Constructor; Object Oriented Programming System : Classes and Objects, Modifiers, Inner Classes; Inheritance; Super,This,Static and Final Keywords; Polymorphism: Method Overloading, Method Overriding; Abstraction, Interfaces; Exception Handling, Create Own Exceptions; Multithreading ; Packages, Collections Framework; File Handling; Generics; Introduction to Swing: Layout Management , Swing Components ,Text Fields , Text Areas ,Buttons, Check Boxes, Radio Buttons , Lists, Choices, Scrollbars , Windows ,Menus , Dialog Boxes; **Self Study:** Bytecode in Java ,Bytecode vs Machine code, JRE, Java API,JVM in Java,JVM Architecture, Class Loader,Interpreter in Java Interpreter vs Compiler,Download & Install Java Development Kit JDK,Download Eclipse IDE for Java Developers

**OBJECT ORIENTED PROGRAMMING USING JAVA:**

**PRACTICAL:** All assignments should be performed considering real world applications.

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **FUNDAMENTALS OF JAVA** | **4 HOURS** |
| a) Write a program based on the basics of Java<br>b) Implement a program using Control Statement, Looping, Array | | |
| **PRACTICAL NO.02** | **STRING, STRING BUFFER, STRING BUILDER** | **2 HOURS** |
| a) Program for implementing string operations | | |
| **PRACTICAL NO.03** | **CLASS-OBJECT, METHODS, CONSTRUCTORS AND LAMBDA EXPRESSION** | **4 HOURS** |
| a) Write a program to create Class, declare Member Variables, Define Methods<br>b) Program to define Constructor, Passing Information to a Method or a Constructor.<br>c) Program to define lambda expression | | |
| **PRACTICAL NO.04** | **JAVA INHERITANCE** | **2 HOURS** |
| a) Program to implement all types of Inheritance | | |
| **PRACTICAL NO.05** | **STATIC, FINAL , SUPER AND THIS KEYWORD** | **2 HOURS** |
| a) Program to implement static, final , super and this keyword in java | | |

| | | |
|---|---|---|
| **PRACTICAL NO.06** | **POLYMORPHISM** | **2 HOURS** |
| a) Program to implement polymorphism | | |
| **PRACTICAL NO.07** | **JAVA ABSTRACT CLASS AND INTERFACES** | **2 HOURS** |
| a) Write a program based on Abstract Class<br>b) Write a program based on Interfaces | | |
| **PRACTICAL NO.08** | **EXCEPTION HANDLING** | **2 HOURS** |
| a) Implement a program to handle different exceptions<br>b) Implement a program to create own exception class | | |
| **PRACTICAL NO.09** | **JAVA SWING** | **4 HOURS** |
| a) Write a program for multi threading<br>b) Write a program to create Frame and make use of Layout Management, User Interface Components | | |
| **PRACTICAL NO.10** | **PACKAGES AND COLLECTIONS** | **2 HOURS** |
| a) Implement a program to create own package<br>b) Implement a program based on Java collections | | |
| **PRACTICAL NO.11** | **FILE HANDLING** | **2 HOURS** |
| a) Write a program for file handling operations | | |
| **PRACTICAL NO.12** | **JAVA GENERICS** | **2 HOURS** |
| a) Implement various generic functions and generic class | | |

| **PROBLEM SOLVING USING JAVA:** | | |
|---|---|---|
| **01** | **BASIC PROGRAMMING** | **2 HOURS** |
| **02** | **NUMBER SYSTEM** | **2 HOURS** |
| **03** | **ARRAY** | **2 HOURS** |
| **04** | **MATRIX** | **2 HOURS** |
| **05** | **STRING** | **2 HOURS** |
| **06** | **MATH** | **2 HOURS** |
| **07** | **BIT MANIPULATION** | **2 HOURS** |
| **08** | **SEARCHING AND SORTING** | **2 HOURS** |
| **09** | **INHERITANCE** | **2 HOURS** |
| **10** | **POLYMORPHISM** | **2 HOURS** |
| **11** | **COLLECTION** | **2 HOURS** |

| | | |
|---|---|---|
| 12 | **MULTITHREADING** | **4 HOURS** |
| 13 | **STACK AND QUEUE (FURTHER PRACTICE)** | **2 HOURS** |
| 14 | **FILE PROCESSING (FURTHER PRACTICE)** | **2 HOURS** |

## EXAMINATION SCHEME

1. Continuous Assessment: 20 Marks
2. Mid Semester Practical Examination for Problem Solving: 15 Marks
3. End Semester Practical Examination for OOP(Java): 20 Marks
4. End Semester Practical Examination for Problem Solving: 20 Marks

## TEXT BOOKS


1. Herbert Schildt.(2021). Java The complete reference, 12th Edition, McGraw Hill Education.
2. Cay S. Horstmann, Gary cornell.(2021). Core Java Volume I Fundamentals, 12th Edition, Prentice Hall.


## REFERENCE BOOKS


1. K. Arnold and J. Gosling. (2005).The JAVA programming language, Fourth edition, Pearson Education.
2. Timothy Budd. (2000). Understanding Object-oriented programming with Java, Updated Edition, Pearson Education.
3. C. Thomas Wu. (2006). An introduction to Object-oriented programming with Java, Fourth Edition, Tata McGraw-Hill Publishing company Ltd.


## E-RESOURCES

https://nptel.ac.in/courses/106105191

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF CHEMICAL ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | UNIVERSAL HUMAN VALUES-II |
| | **COURSE CODE** | 2301287 |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : --** | **REVISION NO.** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | 4 | NIL | NIL | 25 | NIL | 75 | 100 |

**COURSE OBJECTIVES :**

2301287.CEO.1: To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

2301287.CEO.2: To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

2301287.CEO.3: To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

2301287.CEO.4: To enhance students confidence by strengthening their Professional Skills and Leadership quality. Thus, this course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

2301287.CEO.5: To develop essential soft skills such as leadership, creative writing, and effective communication through practical activities that encourage collaboration and selfawareness.

2301287.CEO.6: To enhance critical thinking and ethical decision-making skills via scenario-based role plays and group discussions, preparing students for real-world challenges.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301287.CO.1: Evaluate the significance of value inputs in formal education and start applying them in their life and profession [L4].

2301287.CO.2: Analyze the value of harmonious relationship based on trust and respect in their life and profession [L3].

2301287.CO.3: Examine the role of a human being in ensuring harmony in society and nature [L3].

2301287.CO.4: Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession [L4].

2301287.CO.5: Demonstrate improved leadership and communication skills by effectively collaborating and articulating ideas in team settings [L3].

2301287.CO.6: Apply critical thinking and ethical considerations in decision-making, showcasing enhanced time management and problem-solving abilities [L4].

## COURSE ABSTRACT

Every human being has two sets of questions to answer for his/her life: a) what to do? and b) how to do? The first set pertains to the value domain, and the other to the skill domain. Both are complimentary, but value domain has a higher priority. Today, education has become more and more skill biased, and hence, the basic aspiration of a human being, that is to live with happiness and prosperity, gets defeated, in spite of abundant technological progress. This course helps students develop the right understanding and feelings for ethical living. It covers self-exploration, distinguishing between self and Body, building healthy relationships, understanding societal goals, and promoting mutual fulfilment with nature. These insights prepare students to lead ethical lives and professions. Basically, lab is a class that puts together theory and practice on some important soft skills in a dynamic environment. Students shall develop leadership, critical thinking, time management, presentation skills, decisionmaking, emotional intelligence, among others, through very interactive sessions and exercises. This lab will help students succeed in their profession with ethical conduct and collaboration.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction-Basic Human Aspiration, its fulfillment through All-encompassing Resolution** | **3 HOURS** |

**Contents:** The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.

**Self Study:** Exploration of self aspirations and their fulfillment.

| UNIT 2 | Right Understanding (Knowing) - Knower, Known & the Process | 3 HOURS |
|---|---|---|
| **Contents:** The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence its inter-connectedness and co-existence; and finally understanding the role of human being in existence (human conduct).<br>**Self Study:** SWOC Analysis. | | |
| **UNIT 3** | **Understanding Human Being** | **3 HOURS** |
| **Contents:** Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self<br>**Self Study:**Exploration of the relationship between self and other. | | |
| **UNIT 4** | **Understanding Nature and Existence** | **3 HOURS** |
| **Contents:** A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self- awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).<br>**Self Study:** Exploration of the relationship between self and Nature. | | |
| **UNIT 5** | **Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living** | **3 HOURS** |
| **Contents:** Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All- encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence.<br>**Self Study:** Exploration of the relationship between self and Universe. | | |

| **PRACTICALS**: PART A (30 Marks) | | |
|---|---|---|
| **PRACTICAL NO.01** | **Skill development: Leadership Skills** | **4 HOURS** |
| Activities: Group Discussion- 1. Self and Resolution 2. Values and Skills. | | |
| **PRACTICAL NO.02** | **Skill development: Creative Writing Skill** | **4 HOURS** |
| Activities: SWOC analysis, Creative Writing: Assignment (Blog, Essay, Articles etc.). | | |
| **PRACTICAL NO.03** | **Skill development: Time Management** | **4 HOURS** |
| Activities: Debate, Social Project with time management. | | |
| **PRACTICAL NO.04** | **Skill development: Presentation Skills** | **4 HOURS** |
| Activities: Presentation, Picture Description. | | |

| PRACTICAL NO.05 | Skill development: Decision Making, Interpersonal Communication, Emotional intelligence | 4 HOURS |
|---|---|---|
| Activities: Scenario based Decision Making, Role Play- Voice Modulation. | | |
| **PRACTICALS**: PART B (20 Marks) | | |
| **PRACTICAL NO.06** | **Verbal, Reasoning and Aptitude Training** | **24 HOURS** |
| 1. Articles, Tenses, Close Passages<br>2. Vocabulary Test, Verb Agreement, Active/Passive Voice<br>3. Antonyms, Synonyms, Preposition<br>4. Idioms and Phrases, Jumbled Sentences, Reading Comprehension<br>5. Sentence Completion, Sentence Correction, Spotting Error<br>6. Confusing Words, One Word Substitution, Fill in the blanks<br>7. Parts of Speech, Reported Speech, Change of Speech<br>8. Number System<br>9. HCF & LCM , Surds and Indices<br>10. Percentages and Average<br>11. Time and work<br>12. Time, Speed and Distance<br>13. Probability<br>14. Quadratic Equations | | |
| **PRACTICALS**: PART C (24 Marks) | | |
| **PRACTICAL NO.07** | **Final Assessment with Help of Career Assessment Tests** | **15 HOURS** |
| Employability and Aptitude assessment tool. | | |

**TEXT BOOKS**


1. Gaur, R. R., Sangal, R., & Bagaria, G. P. (2010). A Foundation Course in Human Values and Professionals Ethics. Excel Books India.
2. Premvir Kapoor (2022), Professional Ethics and Human Values, Khanna Book Publishing, New Delhi.
3. Tracy, B. (2008). Speak to Win: how to present with power in any situation. Amacom.

**REFERENCE BOOKS/LINKS**


1. A N Tripathy, (2003), Human Values, New Age International Publishers.
2. Meadows, D. H., Meadows, D. H., Randers, J., & Behrens III, W. W. (1972). The limits to growth: a report to the club of Rome (1972). Google Scholar, 91, 2.
3. A Nagraj, (1998), Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
4. Monk, S. (2016). Programming Arduino: getting started with sketches. McGraw-Hill Education.
5. P L Dhar, RR Gaur, (1990), Science and Humanism, Commonwealth Publishers.
6. Subhas Palekar, (2000), How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
7. E G Seebauer& Robert L. Berry, (2000), Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
8. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human
9. B P Banerjee, (2005), Foundations of Ethics and Management, Excel Books.
10. B L Bajpai, ()2004), Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
11. https://www.youtube.com/watch?v=hZSARM4VaVs
12. https://www.youtube.com/watch?v=9-T_zwmnZSc

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF DESIGN** | **W.E.F** | **AY:** 2027 - 2028 (NEP Rev. 2023) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Prototyping |
| | **COURSE CODE** | 23BD251L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

## COURSE OBJECTIVES :

23BD251L.CEO.1: To disseminate different types of prototyping tools and techniques.
23BD251L.CEO.2: To impart the product development cycle through prototype projects.
23BD251L.CEO.3: To inculcate hands-on skills for the development of prototyping as a team.
23BD251L.CEO.4: To develop the ability to transmit multi-prototype information clearly and test the same by demonstration and presentation

## COURSE OUTCOMES :

The students after completion of the course will be able to,

23BD251L.CO.1: Identify the techniques, skills and modern engineering tools [L3]
23BD251L.CO.2: Apply multi-skills to build/develop/prepare a prototypes [L3]
23BD251L.CO.3: Analyze prototypes developed with tools and machines [L4]
23BD251L.CO.4: Evaluate the prototypes work carried out in a team [L5]

**PRACTICAL**

**Course Introduction:**

This course aims to work on a product/prototype development process based on multi-disciplinary aspects such as Mechanical, Civil, Computer, and Chemical modules. The main objective of this course is to learn different types of prototyping techniques, product development processes, etc. Students will learn to design, build and debug different engineering interdisciplinary products as a prototypes in team. Students will complete four modules in a rotational manner. Following is a brief introduction of individual modules such as,

1. Mechanical Prototyping (MP): Students will learn the different principles of Rapid Prototyping Techniques(RPT), model slicing, and 3D printing processes to manufacture a prototype through hands-on experience.

2. Civil Prototyping (CP): Students will learn basic skills of civil engineering and its product design. They perform tasks using concepts of Bamboo Architecture Design, and bamboo joinery by scaling down the structure prototype from selected materials.

3. Software Prototyping (SP): Students will get exposure to the software development life cycle (SDLC), and the use of the AEIOU Framework (Design Thinking) to decide the problem statement and its solution.

4. Chemical Prototyping (CHP): Students will learn and develop different chemical products in the form of chemical prototypes. They will prepare basic products such as sanitizer, bio-diesel, sanitizer, pen ink, soap, etc.

| MODULE: 1/4 | Mechanical Prototyping (MP) | 16 HOURS |
|---|---|---|

**PRACTICAL:**

| PRACTICAL NO. 01 | Introduction to Prototyping | 02 HOURS |
|---|---|---|

1. Introduction to prototyping, types of various prototypes, traditional prototyping vs. advanced rapid Prototyping. Types of rapid prototyping techniques.
2. Demand, applications, and growth of 3D printing in product development.
3. Case studies and need of prototypes in emerging fields like Bio - medicals, defense, manufacturing, aerospace, automobile industry, food industry, aviation,etc.

| PRACTICAL NO. 2 | Basics of CAD Modeling | 02 HOURS |
|---|---|---|

1. Introduction of 2D, 3D modelling using CAD software package.
2. Sketcher-workbench and its applications.
3. Part design workbench with generative sketching. Identify physical constraints of prototyping.

| PRACTICAL NO. 3 | 3D Modeling for Prototyping | 04 HOURS |
|---|---|---|

1. Introduction of 3D modeling and its interaction with prototype machines
2. Geometric modeling, types of geometric models, and solid models.
3. Case study on design based models.

| PRACTICAL NO. 04 | Pre-processing of 3D Model Slicing | 02 HOURS |
|---|---|---|

1. Pre-Processing the 3D Model in Cura software / 3D Slicer/ Eiger for slicing.
2. Selection of orientation of model, support generation, skin and wall thickness, speed and time for slicing and printing.

| PRACTICAL NO. 05 | Demonstration and 3D Printing | 04 HOURS |
|---|---|---|

1. Suitable filament material for 3D printing and selection for additive manufacturing types.
2. Demonstration of 3D printing machines, their pre-setting and filament material loading process.
3. Self-study of Bill of material (BOM).

| PRACTICAL NO. 06 | Project Presentation and Evaluation | 02 HOURS |
|---|---|---|

1. Final Presentation and demonstration of models
2. Demonstration in the video form and upload on YouTube as a digital portfolio.

## REFERENCE BOOK


1. Chua C K, Leong K F (2010) Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific, ISBN-13: 978-981277898.
2. Noorani R (2018), Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley Sons, ISBN: 978-0-471-73001-9.
3. Liou W L (2015), Rapid Prototyping and Engineering Applications: A toolbox for prototype development, CRC Press, ISBN: 978-0849334092.
4. Kamrani A K (2012), Rapid Prototyping: Theory & practice, Springer, ISBN: 978-0-387-23291-1.
5. Kenneth Cooper (2020), Rapid Prototyping Technology: Selection and Application, Marcel Dekker, Inc. New York, ISBN: 082470261.

| MODULE: 2/4 | Civil Prototyping (CP) | 16 HOURS |
|---|---|---|
| **PRACTICAL:** | | |
| **PRACTICAL NO. 01** | **Introduction to Sustainable Materials** | **04 HOURS** |
| Introduction of Prototyping. Uses of sustainable material and its properties. Sustainable Materials- Bamboo, Timber, Recycled material, etc. 3D models and animation of products. Case studies on bamboo structures. | | |
| **PRACTICAL NO. 02** | **Design of Bamboo Joinery** | **04 HOURS** |
| Hands-on practice on different types of joinery. Fish mouth joints, lash joints, lapping joints, etc. Develop new designs of joints. | | |
| **PRACTICAL NO. 03** | **Making of Structures/Product** | **04 HOURS** |
| Making of scaled/scale-down structures/products from the selected material. Products like chairs, stools, tensegrity structure, slit techniques, road barriers, etc. | | |
| **PRACTICAL NO. 04** | **Cost Analysis for the Structure/Product** | **02 HOURS** |
| Detailed cost estimation/analysis of the structure/product. | | |
| **PRACTICAL NO. 05** | **Final Video Presentation (Evaluation)** | **02 HOURS** |
| Final Presentation and demonstration of models. Demonstration in the video form and upload on YouTube as a digital portfolio. | | |

**REFERENCE BOOK**


1. Beer & Johnston (2018), Vector Mechanics for Engineers: statics and dynamics, 10th edition, McGraw Hill Education, ISBN: 978-0073398242.
2. Chris van Uffelen (2013), Bamboo Architecture & Design (Architecture & Materials), by ISBN: 978-3037681824.
3. Jules J.A. (2015), Designing and Building with Bamboo, Janssen Technical University of Eindhoven Eindhoven, The Netherlands, ISBN 978-8186247464.

| MODULE: 3/4 | Software Prototyping (SP) | 14 HOURS |
|---|---|---|
| **PRACTICAL:** | | |
| **PRACTICAL NO. 01** | **Introduction to Software Engineering** | **02 HOURS** |
| Concepts, Software development life cycle (SDLC). Students need to use AEIOU Framework (Design Thinking) to decide the problem statement. Students will work in groups of three on the AEIOU framework | | |
| **PRACTICAL NO. 02** | **Requirement Analysis** | **02 HOURS** |
| Find the requirement specification of a given problem statement and formulate the feasible solution. | | |
| **PRACTICAL NO. 03** | **Design UML Diagrams for given Problem Statement** | **02 HOURS** |
| Project Development Canvas and then design the following, using a lucid chart tool. Creation of use case diagram, design of an activity diagram, design of Sequence diagram. | | |
| **PRACTICAL NO. 04** | **Design Analysis** | **02 HOURS** |
| Create High Fidelity Prototype using proto.io | | |
| **PRACTICAL NO. 05** | **Prototype Implementation** | **04 HOURS** |
| Web site development using tools such as HTML, JSCRIPT, Proto.io, Invision etc. | | |
| **PRACTICAL NO. 06** | **Presentation** | **02 HOURS** |
| Each group will be given 10 min to present their work | | |

**REFERENCE BOOK**


1. Roger S, Pressman (2016), Software Engineering A practitioner's Approach, 7th Edition, ISBN: 9780073375977.
2. Jonathan Arnowitz, MichaleArent (2014), Effective prototyping for software Makers, ACM Digital Library, ISBN-13:978-0120885688
3. Chua, C. K., Leong, K. F. (2010), Rapid Prototyping: Principles and applications in manufacturing, New York: Wiley, ISBN: 978-9812778987.
4. Fab - Gershenfeld, N. (2018), The coming revolution on your desktop - from personal computer to personal fabrication, New York: Basic Books. ISBN:978-0465027453.
5. Noorani, R. (2016), Rapid prototyping: Principles and applications, NJ: Wiley.ISBN: 978-0-471-73001-9.
6. Pham D. T.,Dimov S. S. (2011), Rapid manufacturing: The technologies and applications of rapid prototyping and rapid tooling, New York: Springer. ISBN: 978-1447111825.

| MODULE: 4/4 | Chemical Prototyping | 14 HOURS |
|---|---|---|
| **PRACTICAL:** | | |
| **PRACTICAL NO. 01** | **Introduction to manufacturing process** | **02 HOURS** |
| Introduction to chemical prototype and manufacturing process. Selection of manufacturing product and method. | | |
| **PRACTICAL NO. 02** | **Basic material selection** | **04 HOURS** |
| Introduction of the method and material selection. Block diagram for the process. | | |
| **PRACTICAL NO. 03** | **Manufacturing of the Product** | **06 HOURS** |
| Used unit operation and raw material for manufacturing and performance of actual experimentation | | |
| **PRACTICAL NO. 04** | **Project presentation** | **02 HOURS** |

1. Final Presentation and demonstration of models.
2. Report submission (Final Assessment and Evaluation).

List of manufacturing products:

1. Preparation of Soap
2. Preparation of Sanitizer
3. Preparation of detergent powder
4. Preparation of bio-diesel
5. Preparation of talcum powder
6. Preparation of biscuits
7. Preparation of bread
8. Preparation pen ink
9. Preparation of food color
10. Preparation of herbal hair dye
11. Preparation of herbal juice
12. Preparation of Oxalic Acid from sugar cane
13. Preparation of urea-formaldehyde resin
14. Preparation of phenol formaldehyde resin, etc.

**REFERENCE BOOK**


1. Richard A. Winter (2009), A Prototype Chemical Substances Information Network, Computer Corporation of America, Council on Environmental Quality (U.S.), Computer Corporation of America.
2. Pawel L. Urban, (2018), Prototyping Instruments for the Chemical Laboratory Using Inexpensive Electronic Modules, https://doi.org/10.1002/anie.201803878.
3. Coulson J.M, et al (1999), Chemical Engineering, Vol. 1 & 2, Butter worth Heinemann, 6th Edition, ISBN 9780080494227.
4. Foust A.S, Principles of Unit Operations (2007), John Wiley, ISBN 9780471268963.
5. Seader J.D & Henley E.J (2016), Separation Process Principles, John Wiley, 2nd Edition, ISBN 9780471586265.
6. McCabe W. L. and Smith J.C.(1993), Unit Operations in Chemical Engineering, 5th Edition, McGraw Hill Publications,ISBN 007448442.
7. Badger W. L and Banchero J.T. (2015), Introduction to Chemical Engineering, McGraw Hill Publications, ISBN 0070029954.
8. Austin G.T, Sherves (2016), Chemical Process Industries, 5th Edition, McGraw Hill, (ISBN: 9780070661677).

## ANNEXURE

Each module will have an average of seven laboratory sessions. The students will complete two modules before the mid-semester exam and another two modules after mid-semester exam, in a rotational manner. Marks of four modules at a time will be averaged in one semester and if a student secures passing marks (passing grade) after averaging; then the required credits of the course will be earned.

### A) Course Execution:

| **III Semester - Upto Mid-Semester Exam** | | | |
|---|---|---|---|
| **Module** | **School** | **Module** | **School** |
| 1)Mechanical Proto | Computer Engineering | 3)Computer Proto | ENTC/ETX |
| 2)Civil Proto | | 4)Chemical Proto | |

| **III Semester - After Mid-Semester Exam** | | | |
|---|---|---|---|
| **Module** | **School** | **Module** | **School** |
| 1)Mechanical Proto | ENTC/ETX | 3)Computer Proto | Computer Engineering |
| 2)Civil Proto | | 4)Chemical Proto | |

| **IV Semester - Upto Mid-Semester Exam** | | | |
|---|---|---|---|
| **Module** | **School** | **Module** | **School** |
| 1)Mechanical Proto | Civil and Chemical Engineering | 3)Computer Proto | Mechanical Engineering |
| 2)Civil Proto | | 4)Chemical Proto | |

| **IV Semester - After Mid-Semester Exam** | | | |
|---|---|---|---|
| **Module** | **School** | **Module** | **School** |
| 1)Mechanical Proto | Mechanical Engineering | 3)Computer Proto | Civil and Chemical Engineering |
| 2)Civil Proto | | 4)Chemical Proto | |

**B) Evaluation Structure:**

| **Prototyping Module** | | **Group Size** | **Demo / Presentation** (40 Marks) | | | **Continuous Activities** (35 Marks) | | **Total Marks** (75 Marks) |
|---|---|---|---|---|---|---|---|---|
| No. | Name | Student | Submission Mode | Report | PPT/ Video | Activity | Quiz | Total Activity |
| 1 | Mechanical | 5 | Report & Video/PPT | Yes | Yes | 02 | 01 | 05 |
| 2 | Civil | 5 | Report & Video | Yes | Yes | 02 | 01 | 05 |
| 3 | Computer | 5 | Presentation | Yes | Yes | 03 | 00 | 05 |
| 4 | Chemical | 5 | Report & Video/PPT | Yes | Yes | 02 | 01 | 05 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2027 - 2028 (Rev. 2023 (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Applied Mathematics |
| | COURSE CODE | 2301255T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301255T.CEO.1: To summarize different types of signals

2301255T.CEO.2: To demonstrate the Laplace transform of continuous time signals.

2301255T.CEO.3: To construct the integral representation of functions using Fourier series and transform.

2301255T.CEO.4: To illustrate the Z transform of discrete time signals.

2301255T.CEO.5: To summarize the rank, eigenvalues and eigenvectors of a matrix.

2301255T.CEO.6: To characterize probability models and function of random variables

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2301255T.CO.1: Obtain the classification and operations of signals and systems based on their properties in continuous and discrete domains [L3].

2301255T.CO.2: Apply concepts of signals and systems based on their properties, random variables, probability distributions, rank, eigenvalues and eigenvectors of a matrix [L3].

2301255T.CO.3: Apply concepts of the transforms to check the output response, stability of the systems in continuous and discrete domains [L3].

## COURSE ABSTRACT

Applied mathematics is the application of mathematical methods by different fields such as physics, engineering, medicine, biology, finance, business, computer science, and industry. Thus, applied mathematics is a combination of mathematical science and specialized knowledge. The term "applied mathematics" also describes the professional specialty in which mathematicians work on practical problems by formulating and studying mathematical models. This course is designed to develop substantial mathematical skills and methods needed in other subject areas. Applied mathematics consisted mostly of applied analysis, most notably: differential equations; real and complex analysis; Fourier analysis; transforms as well as linear algebra and applied probability, outside of analysis. The course content will help students to develop a sound understanding of transforms like Laplace, Z and linear algebra and applied probability which they can use to describe and analyse a given signal and to further make meaningful inferences out of it.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction** | **07 HOURS** |

**Case Study:** Basics of Speech, Image and Medical signals

**Contents:** Definition of signals, Elementary signals, Basic operation on signals, Classification of signals, Definition of systems, Classification of systems.

**Further Reading:** Vector and orthogonal vector space,

| | | |
|---|---|---|
| **UNIT 2** | **Laplace Transform** | **07 HOURS** |

**Case Study:** Circuit Analysis, System Modeling

**Contents:** Introduction of Laplace Transform and Inverse Laplace Transform, Properties, Unit Step function, Impulse Function and Periodic Functions, Solution and analysis of linear differential equation to linear system.

**Self Study:** Solution of an an ordinary differential equation (ODE's)

| | | |
|---|---|---|
| **UNIT 3** | **Fourier Series and Fourier Transform** | **08 HOURS** |

**Case Study:** Audio Signal Analysis

**Contents:** Introduction to Fourier series, determination of Fourier constants, Even and odd function series, arbitrary period functions series.

Introduction of Fourier Transform and its properties, Fourier Sine and Cosine Transform, Inverse Fourier transforms, Analysis of frequency response.

**Self Study:** Half ranges series, Complex exponential form of Fourier series and Fourier Integral Theorem

| | | |
|---|---|---|
| **UNIT 4** | **Z Transform** | **07 HOURS** |

**Case Study:** Digital Filters

**Contents:** Z-transform: Introduction, Definition, Z-transform of standard functions

Inverse Z- transform: Introduction, Partial fraction method, Inversion integral method, Solution to the difference equation.

**Self Study:** Pole-Zero stability in Z domain, Connection between the Laplace Transform and the Z-Transform.

| UNIT 5 | Linear Algebra | 08 HOURS |
|---|---|---|

**Case Study:** Singular Value Decomposition (SVD)

**Contents:** Basic Concepts, Matrix Addition, Scalar Multiplication, Matrix Multiplication, Linear Systems of Equations, Gauss Elimination Method, Rank of a Matrix, Linear Independence, Vector Spaces, Inner Product Spaces.

Eigenvalues, Eigenvectors, Symmetric Matrices, Skew-Symmetric Matrices, Orthogonal Matrices, Similarity of Matrices, Basis of Eigenvectors.

**Self Study:** Digonalization

| UNIT 6 | Probability and Random Variables | 08 HOURS |
|---|---|---|

**Case Study:** Wireless Communication

**Contents:** Classical Probability, Frequency Interpretation, Probability Space, Exclusive & exhaustive events, Bayes Rule, Statistical Independence, Joint, Marginal and Conditional probability, Total Probability.

Random Variables, continuous and discrete RV, Probability distribution functions, probability density function, probability mass functions, Correlation, Covariance, Central Limit theorem, CDF and CCDF

**Self Study:** Special pdfs: Gaussian, Rayleigh, Uniform, Binomial and Poisson distributions

## TEXT BOOKS


1. Dr. B.V. Ramana, (2017). *Higher Engineering Mathematics*, 5$^{th}$ edition, Tata McGraw Hill, ISBN: 978-0-07-063419-0.
2. Ram N. Patel, Ankush Mittal, (2014). *Programming in MATLAB- A Problem solving approach*. Pearson Education, ISBN-978-93-325-2481-1.
3. Athanasios Papoulis, Unnikrishna Pillai, *Probability - Random Variables and Stochastic Processes*, McGraw Hill Education, 4$^{th}$ Edition, ISBN: 978-0070486584.
4. Steven Kay, *Fundamentals of Statistical Signal Processing: Estimation theory*, Prentice Hall


## REFERENCE BOOKS


1. B.S. Grewal, (2018). *Higher Engineering Mathematics*, 44$^{th}$ edition, Khanna Publications, ISBN: 978-81-933284-9-1.
2. Erwin Kreyszig, (2015). *Advanced Engineering Mathematics*, 10$^{th}$ edition, Wiley Eastern Ltd., ISBN: 13: 9788126554232.
3. Amos Gilat, (2003). *MATLAB: An Introduction with Applications*, 4$^{th}$ edition, Wiley Publication, ISBN-13: 9788126537204.
4. H. Stark, J. W.Woods, (2003). *Probability and Random Processes with Applications to Signal Processing*, Pearson, ISBN: 978-0130200716.
5. Peyton Z. Peebles Jr., (2002). *Probability, Random Variables and Random Signal Principles*, 4$^{th}$ Edition, Tata McGraw-Hill, New Delhi, ISBN: 978-0071127820

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2027 - 2028 (Rev. 2023 (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Applied Mathematics Lab |
| | COURSE CODE | 2301255L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2301255L.CEO.1: To perform various operations on signals in both continuous and discrete domains.

2301255L.CEO.2: To illustrate the Laplace, Fourier and Z transform of continuous and discrete time signals.

2301255L.CEO.3: To enhance problem-solving and critical thinking skills by addressing real-world challenges and developing innovative solutions in the context of signal processing applications.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2301255L.CO.1: Perform different operations on signals based on their properties in continuous and discrete domains using modern tools [L3]

2301255L.CO.2: Analyse the different transforms using modern tools to check the output response, stability of the systems in continuous and discrete domain [L4]

2301255L.CO.3: Inspect the real time case scenarios in a team and make an effective presentation on the application of signal processing from different domains [L4]

## COURSE ABSTRACT

Applied mathematics is the application of mathematical methods by different fields such as physics, engineering, medicine, biology, finance, business, computer science, and industry. Thus, applied mathematics is a combination of mathematical science and specialized knowledge. The term ”applied mathematics” also describes the professional specialty in which mathematicians work on practical problems by formulating and studying mathematical models. This course is designed to develop substantial mathematical skills and methods needed in other subject areas. Applied mathematics consisted mostly of applied analysis, most notably: differential equations; real and complex analysis; Fourier analysis; transforms as well as linear algebra and applied probability, outside of analysis. The course content will help students to develop a sound understanding of transforms like Laplace, Z and linear algebra and applied probability which they can use to describe and analyse a given signal and to further make meaningful inferences out of it.

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | | **6 HOURS** |
| Introduction to MATLAB: Syntax, keywords, matrices, polynomials, loops. | | |
| **PRACTICAL NO.02** | | **6 HOURS** |
| Introduction to MATLAB: In-built functions, 2D/3D plots, creating simple programs. | | |
| **PRACTICAL NO.03** | | **6 HOURS** |
| Finding Fourier transforms of functions, Plotting of transforms. | | |
| **PRACTICAL NO.04** | | **6 HOURS** |
| Finding Laplace transforms of functions, solution of differential equations using Laplace transforms. | | |
| **PRESENTATION** | | **6 HOURS** |

Prepare an presentation based on any application in domain like automation, communication, power electronics, embedded system etc. and present the same.
The presentation should include:

- Survey for selection of an topic in the mentioned domains. Selected topic must be supported by any research documents like international conferences, journal papers, application notes or any reference books.
- Detail explanation of the transform and methodologies used in the selected topic.
- Major findings in the topic.

**Note:** Points will also be awarded for creativity and difficulty level in the topics.

## TEXT BOOKS


1. Dr. B.V. Ramana, (2017). *Higher Engineering Mathematics*, 5th edition, Tata McGraw Hill, ISBN: 978-0-07-063419-0.
2. Ram N. Patel, Ankush Mittal, (2014). *Programming in MATLAB- A Problem solving approach*. Pearson Education, ISBN-978-93-325-2481-1.
3. Athanasios Papoulis, Unnikrishna Pillai, *Probability - Random Variables and Stochastic Processes*, McGraw Hill Education, 4th Edition, ISBN: 978-0070486584.
4. Steven Kay, *Fundamentals of Statistical Signal Processing: Estimation theory*, Prentice Hall


## REFERENCE BOOKS


1. B.S. Grewal, (2018). *Higher Engineering Mathematics*, 44th edition, Khanna Publications, ISBN: 978-81-933284-9-1.
2. Erwin Kreyszig, (2015). *Advanced Engineering Mathematics*, 10th edition, Wiley Eastern Ltd., ISBN: 13: 9788126554232.
3. Amos Gilat, (2003). *MATLAB: An Introduction with Applications*, 4th edition, Wiley Publication, ISBN-13: 9788126537204.
4. H. Stark, J. W.Woods, (2003). *Probability and Random Processes with Applications to Signal Processing*, Pearson, ISBN: 978-0130200716.
5. Peyton Z. Peebles Jr., (2002). *Probability, Random Variables and Random Signal Principles*, 4th Edition, Tata McGraw-Hill, New Delhi, ISBN: 978-0071127820

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (NEP Rev. 2023) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Project Design |
| | **COURSE CODE** | 2307291L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE:** Knowledge of engineering fundamentals.

## COURSE OBJECTIVES :

2307291L.CEO.1: To develop a sense of curiosity and critical thinking approach for designing solutions to the real world problems.

2307291L.CEO.2: To disseminate the project planning-scheduling techniques and industry standards.

2307291L.CEO.3: To cognize the ethical principles, industry standards in general and its importance in project documenting and ethical writing.

2307291L.CEO.4: To encourage to integrate the multiple project design ideas.

2307291L.CEO.5: To encourage to work in a team and cooperate the team members.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2307291L.CO.1: Design solutions for solving real world problems using critical thinking systematic approach [L3].

2307291L.CO.2: Plan the project activities with respect to timeline, skills and resources required considering the project costs estimations [L3].

2307291L.CO.3: Apply the knowledge of professional ethics and Industry standards for project design and documentation [L3].

2307291L.CO.4: Demonstrate an ability to integrate the multiple project design ideas to develop the designs of product/ processes/ software [L4].

2307291L.CO.5: Demonstrate an ability to work in a team and cooperate the team members by showing the responsible behaviour [L5].

## COURSE ABSTRACT

It is a need of the time to pay attention to the societal needs by an engineering graduate to solve some of the real life societal problems by providing affordable technological solutions. The concept of the field project follows the same theme. The project design aims to identify the problems that are faced by the society and develop the systems / processes / products to provide solutions for the same using science and technology for the betterment of society or human life. This may help students to understand the process of product/project development, best practices and encourage their creativity to solve real life problems. The students shall refer scientific literatures from the books, journals of repute. The students shall learn effective team building, designing, budgeting, planning, engineering skills and processes, safety norms and industry standards while developing the application/ products / processes. The students shall learn the importance of technical documentation and professional ethics.

## Guidelines

1. Every student shall undertake the Project in semester III and IV.
2. Every student shall work on an approved project, preferably a field project to work in a group of 03/04 (Max.) students.
3. The group members may be from different programme to support the interdisciplinary / multi-disciplinary functioning.
4. The students have to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
5. Collect the sufficient data and survey to establish the criticality of the problem to be solved.
6. Apply various tools for project planning and design.
7. Critically analyze various design solutions/techniques to solve real world problems.
8. Select and justify one of the solutions identified based on the feasibility, affordability and ease of use.
9. Learn and apply industry standards and professional ethics.
10. Adherence to the highest principles of ethics, conduct and practices.

## TIMELINE

The THREE member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Formation of Project Group and topic exploration: 2 Weeks ($1^{st}$ and $2^{nd}$ week)
2. Finalizing title, survey, feasibility study and approval: 3 Weeks ($3^{rd}$ to $5^{th}$ week)
3. Engineering Ethics: $3^{rd}$ week
4. Project Review 1 Presentation: $6^{th}$ week
5. Analysis and Design of the Project: 3 Weeks ($7^{th}$ to $9^{th}$ week)
6. Project Review 2 Presentation: $10^{th}$ week
7. Report Writing, Documentation and Presentation: 2 Weeks ($11^{th}$ and $12^{th}$ week)
8. Project report assessment by the guide and review panel: 2 Weeks ($13^{th}$ and $14^{th}$ week)
9. Final Evaluation/Examination Presentation: $15^{th}$ week

**Project Demonstration (50 Marks)**

1. **Review 1 (05 marks)**
   - Demonstrate an ability to define precise Problem Statement, Project objectives and Scope, Project Planning, application of Project management tools.
2. **Project Activities (05 Marks)**
   - Demonstrate an ability to identify situations of unethical professional conduct and propose ethical alternatives.
   - Demonstrate Commitment towards practicing the Professional Ethics and moral.
   - Demonstrate an ability to apply the Code of Ethics
3. **Review 2 (Project Modeling and Designing, Block diagram, Flow chart, etc.) (10 marks)**
   - Write detailed Literature Review, Need and Significance of Study, Methodology, Block Diagram, Flow Chart, Engineering drawings, etc.
4. **Project Documentation (10 marks)**
   - Produce clear, well-constructed, and well-supported written engineering documents, project cost sheet and plagiarism report.
5. **Final project demonstration & Project team presentation (20 marks)**
   - Demonstrate effective communication,Implement the norms of standard professional practices, Present results as a team showing the responsible behaviour.

**TEXT BOOKS**


1. Schmidt, T. (2009). Strategic Project Management Made Simple. 2nd Edition, Wiley Pub, India.(ISBN 978-1-119-71817-8)
2. Challender, J. (2022). Professional Ethics in Construction and Engineering, Wiley .(ISBN-13: 978-1-119-83210-2)
3. Rogerson, S. (2003) Computer Ethics and Professional Responsibility. 1st Edition Wiley Blackwell Publication.(ISBN-13: 978-1855548459)
4. Nagarazan, R.S. (2022). A Textbook on Professional Ethics and Human Values. New Age Publication, (ISBN-13: 978-81-224-2301-3)
5. Hering, L. and Hering H. (2005). How to write Technical Reports. Springer (ISBN : 978-3-540-69929-3)


**REFERENCE BOOKS**


1. Zwikael, O. and Smyrk, J. (2019). Project Management A Benefit Realization Approach. Springer Publication, (ISBN-13: 978- 0134877693)
2. Handley, W. (1977). Industrial Safety Handbook. 2nd Revised edition ,McGraw-Hill Companies;, (ISBN-13: 978-0070844810)
3. Mislick, G. and Mussbaum, D. (2015) Cost Estimation: Methods and Tools. Wiley, (ISBN-13: 978-1-118-53613-1)
4. Chilcutt, A. and Adam, J. (2019). Engineered to Speak: Helping You to Create and Deliver Engaging Technical Presentations. Wiley, (ISBN-13: 978-1-119-47496-8)

## E-CONTENTS/VIRTUAL LAB/ONLINE SIMULATOR LINKS

1. University of California, free online course: https://www.classcentral.com/course/project-planning-1-12208
2. International Journal of Project Management : https://www.sciencedirect.com/journal/international-journal-of-project-management
3. Free software tool for project Management : https://onlinepmcourses.com/project-management-tools/free-project-management-resources/
4. Research Article: https://doi.org/10.1016/j.tsc.2024.101477
5. Research Article: https://doi.org/10.1016/j.ijproman.2024.102584

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP) ) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | ARM Based Embedded System Design |
| | **COURSE CODE** | 2307220T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307220T.CEO.1: To impart knowledge of basic terminologies associated with microcontrollers.
2307220T.CEO.2: To understand the architecture of ARM.
2307220T.CEO.3: To illustrate the configuration of internal peripherals of ARM MCU.
2307220T.CEO.4: To familiarize with the programming model of ARM MCU .
2307220T.CEO.5: To provide exposure of ARM MCU interfacing with the real world.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307220T.CO.1: Interpret the basic terminologies commonly used for different microcontrollers [L2].
2307220T.CO.2: Identify ARM MCUs for specific applications [L2].
2307220T.CO.3: Describe the functional blocks of ARM MCU [L2].
2307220T.CO.4: Configure internal peripherals of ARM MCU through programming [L3].
2307220T.CO.5: Build basic applications using ARM MCU [L4].

**COURSE ABSTRACT:**

This course provides a comprehensive overview of microcontrollers covering key concepts such as their evolution, different architectures, features and selection criteria. The curriculum covers programming aspects, and introduces essential software tools along with IDE. The course focuses on different ARM processors, highlighting their features and advantages and the major focus is on ARM Cortex-M4 based MCU architecture. This 32-bit MCU is discussed in detail covering its hardware and programming model. For hands-on configuring and programming GPIOs, Clocks, Timers, ADC are included. Real-world applications and case studies are included for more insights.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Overview of Microcontrollers** | **08 HOURS** |

**Applications/Case Study:** Application examples of some standalone automated systems.

**Contents:** Architectural Aspects: Microprocessor Evolution, Microprocessor vs Microcontroller, Microcontroller Architectures: CISC vs RISC, Harvard vs Von-Neumann, Bus Structure, Memory types and organization, Selection criteria for choosing a microcontroller, Feature comparison of 8-bit and 32-bit microcontrollers, Recent trends and applications. Programming Aspects: High-Level vs Low-Level programming, Assembler, Compiler, Debugger, STM Cube IDE

**Further Readings/Self Study:** Survey of most popular microcontrollers with feature comparison, resource availability and development boards.

| | | |
|---|---|---|
| **UNIT 2** | **ARM Philosophy** | **08 HOURS** |

**Applications/Case Study:** Why APPLE has shifted to ARM?

**Contents:** RISC design philosophy, ARMs approach towards RISC, ARM processors and its versions, ARM7, ARM9 ARM11 features, advantages. Introduction to ARM CORTEX series processors, Features Applications, Improvement of CORTEX over classical series, Survey on ARM Cortex based microcontrollers, its features and comparison, CORTEX-M4 Core architecture.

**Further Readings/Self Study:** Comparative study of ARM processor-based architecture variants.

| | | |
|---|---|---|
| **UNIT 3** | **ARM CORTEX-M4 Powered MCU** | **08 HOURS** |

**Applications/Case Study:** Discussion on family of popular development boards.

**Contents:** Basic features of STM32 (ARM Cortex-M4 based 32-bit MCU by ST Microelectronics), Comparison with other Cortex-M4 series processor based MCUs, Architecture, Pin configuration, Memory map, Bus interface, Reset and Supply Management

**Further Readings/Self Study:** STM32 Datasheet and Reference Manual Interpretation.

| | | |
|---|---|---|
| **UNIT 4** | **GPIOs and Clock Configuration** | **08 HOURS** |

**Applications/Case Study:** Discussion on some switching applications around GPIOs.

**Contents:** GPIOs programming structure and registers, GPIO modes with high-impedance state, pull-up and pull-down state, open drain state and push-pull state, Enabling and Disabling of GPIO peripheral clock. MCU Clocks, MCU Clock Configuration, Peripheral Clock and Reset Control.

**Further Readings/Self Study:** Datasheet interpretations for GPIOs and Clock Configuration.

| UNIT 5 | Peripheral Configuration and Programming | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Live Project Demonstration

**Contents:** Configure and Program GPIOs for Real-World interfacing: Interfacing external peripherals like LEDs, LCD, Relay, Push button with STM32 microcontroller. Configure and Program inbuilt Timers: Understanding general purpose timers input capture unit, output compare unit, PWM, Sample application implementation. Configure and Program inbuilt Analog-to-Digital Convertor: ADC registers, ADC clock configuration, ADC sample application implementation.

**Further Readings/Self Study:** Interfacing Seven-Segment Display and capacitive touch switch with MCU.

## TEXT BOOKS


1. Yiu, J.(2013). *The Denitive Guide to ARM Cortex-M3 and Cortex-M4 Processors*. 3rd Edition, Newnes. ISBN 978-0124080829.
2. Sloss, A., Symes, D., Wright, C. (2014). *ARM System Developers Guide Designing and Optimizing System Software*. 1st Edition, Morgan Kaufmann Publishers. ISBN 1-55860-874-5.


## REFERENCE BOOKS


1. Mazidi, M., Chen, S., Ghaemi, E. (2018). *STM32 Arm Programming for Embedded Systems*. 6th Edition, Microdigitaled. ISBN 978-0997925944.
2. Norris, D. (2018). *Programming with STM32: Getting Started with the Nucleo Board and C/C++*. 6th Edition, McGraw Hill. ISBN 978-1260031317.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | ARM based Embedded System Design |
| | **COURSE CODE** | 2307220L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2307220L.CEO.1: To provide students thorough understanding of the ARM development tools.
2307220L.CEO.2: To develop practical understanding of ARM architecture through experimentation.
2307220L.CEO.3: To integrate hardware and software in ARM-based systems.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307220L.CO.1: Identify and describe functions of ARM-based development tools [L2].
2307220L.CO.2: Demonstrate the ability to write and debug programs for ARM microcontrollers [L3].
2307220L.CO.3: Utilize systematic problem-solving techniques for embedded systems [L4].

## COURSE ABSTRACT:

This course provides a comprehensive overview of microcontrollers covering key concepts such as their evolution, different architectures, features and selection criteria. The curriculum covers programming aspects, and introduces essential software tools along with IDE. The course focuses on different ARM processors, highlighting their features and advantages and the major focus is on ARM Cortex-M4 based MCU architecture. This 32-bit MCU is discussed in detail covering its hardware and programming model. For hands-on configuring and programming GPIOs, Clocks, Timers, ADC are included. Real-world applications and case studies are included for better insights.

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **Familiarization with 8-bit Microcontroller Board** | **2 HOURS** |
| Interfacing LEDs, Relay and Buzzer with 8051 Microcontroller Board | | |
| **PRACTICAL NO.02** | **Familiarization with IDE and Development Board** | **2 HOURS** |
| To perform the study of STM32 Nucleo Development Board and familiarization with STM32CubeIDE | | |
| **PRACTICAL NO.03** | **Familiarization with IDE and Development Board** | **2 HOURS** |
| To perform editing, compiling, debugging, burning hex file for STM32 Nucleo Board via STLink | | |
| **PRACTICAL NO.04** | **Familiarization with IDE and Development Board** | **2 HOURS** |
| To perform GPIO Configuration of STM32 Nucleo Board using STM32CubeIDE | | |
| **PRACTICAL NO.05** | **Configuring GPIOs of STM32 Nucleo Board** | **2 HOURS** |
| Interfacing LEDs, Relay and Buzzer with STM32-Nucleo Board | | |
| **PRACTICAL NO.06** | **Configuring GPIOs of STM32 Nucleo Board** | **2 HOURS** |
| Interfacing a tactile push-button and seven-segment display with STM32-Nucleo Board | | |
| **PRACTICAL NO.07** | **Configuring GPIOs of STM32 Nucleo Board** | **2 HOURS** |
| Interfacing an alphanumeric display with STM32-Nucleo Board | | |
| **PRACTICAL NO.08** | **Configuring Inbuilt Peripherals** | **2 HOURS** |
| Implementation of Timers in STM32-Nucleo Board | | |
| **PRACTICAL NO.09** | **Configuring Inbuilt Peripherals** | **2 HOURS** |
| Implementation of PWM in STM32-Nucleo Board | | |
| **PRACTICAL NO.10** | **Interfacing Sensors and Actuators** | **4 HOURS** |
| Interfacing STM32 Nucleo Board with Analog Sensor and Actuator | | |
| **PRACTICAL NO.12** | **Laboratory Project and Demonstration** | **4 HOURS** |
| Demonstration of Laboratory project implementing a problem statement on ARM based Development Board.<br>Presentation of implementation of results for Practical 1 to 7 for assigned problem statement | | |

## TEXT BOOKS


1. Yiu, J.(2013). *The Denitive Guide to ARM Cortex-M3 and Cortex-M4 Processors*. 3rd Edition, Newnes. ISBN 978-0124080829.
2. Sloss, A., Symes, D., Wright, C. (2014). *ARM System Developers Guide Designing and Optimizing System Software*. 1st Edition, Morgan Kaufmann Publishers. ISBN 1-55860-874-5.


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| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP) ) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Principles of Communication System |
| | **COURSE CODE** | 2307221T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307221T.CEO.1: To introduce the students with the fundamental concepts of communication systems.
2307221T.CEO.2: To provide deep insights of analog digital modulation and demodulation techniques.
2307221T.CEO.3: To familiarize students with transmitter and receiver techniques.
2307221T.CEO.4: To make students to examine interference and the performance of digital communication system.
2307221T.CEO.5: To provide the exposure of working of wireless communication technologies.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307221T.CO.1: **Illustrate** the fundamental concepts, terminologies and working of communication systems. [L2]
2307221T.CO.2: **Solve** complex engineering problems applying the knowledge of modulation in communication engineering. [L3]
2307221T.CO.3: **Compare** different communication systems based on various parameters such as bandwidth, power, signal-to-noise ratio, and interference. [L4]
2307221T.CO.4: **Analyze** the link budget of satellite communication systems considering given transmitter, receiver, and interference parameters. [L4]

**COURSE ABSTRACT:** (Brief description of course contents)

This course covers fundamental concepts of communication systems, which are essential for the understanding of advanced courses of analog & digital, wired & wireless communication systems. Beginning with various basic principle as elements of communication system, the course also cover several important analog and digital modulation techniques such as Amplitude Modulation, Frequency Modulation, Phase Modulation, and other passband and baseband modulations. Sampling process and Quatization, including Nyquist criterion and reconstruction of the original signal from the sampled signal will be dealt with in the later parts of the course.The course further address the working principles and prerequisits of advance communication technologies including cellular communication and satellite communication system.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Analog Modulation Techniques** | **08 HOURS** |

**Applications/Case Study:** Picture and sound modulation in TV

**Contents:** Elements of communication Systems, Noise, Types of analog modulation, Types of Amplitude and Angle modulation, Transmitter & receiver working.

**Further Readings/Self Study:** Survey of RF modulators for various applications.

| | | |
|---|---|---|
| **UNIT 2** | **Pulse Modulation Techniques** | **05 HOURS** |

**Applications/Case Study:** Audio sampler

**Contents:** Low pass sampling, Aliasing, Signal Reconstruction, Quantization, Uniform & non-uniform Quantization, quantization noise, Logarithmic Companding, Pulse modulationPAM, PPM, PWM, PCM

**Further Readings/Self Study:** Sampler circuits

| | | |
|---|---|---|
| **UNIT 3** | **Digital Modulation Techniques** | **06 HOURS** |

**Applications/Case Study:** Modulation technique at Satellite transponder

**Contents:** Block diagram, advantages of digital communication, Modulation for Bandwidth-Limited Channels: Intersymbol interference, Equalization, error performance; Passband Digital Transmission via Carrier Modulation: ASK, FSK,PSK,BPSK, QPSK, BFSK

**Further Readings/Self Study:** : Comparison of analog & Digital modulation technique

| | | |
|---|---|---|
| **UNIT 4** | **Cellular Communication** | **06 HOURS** |

**Applications/Case Study:** Mobile Trans-receivers modules of smart phones

**Contents:** Introduction to Cellular Communications, Frequency reuse, Multiple Access Technologies, Cellular Processes Call Setup and Handover.

**Further Readings/Self Study:** Evolution of wireless technologies 1G to 5G in mobile communication

| UNIT 5 | : Satellite Communication | 06 HOURS |
|---|---|---|

**Applications/Case Study:** DTH reception of satellite signal

**Contents:** Overview of satellite communications systems, historical developments, Keplers Laws, station keeping, geo-stationary and non Geo-stationary orbits Look Angle Determination- Basic link analysis, Interference analysis.

**Further Readings/Self Study:** GPS satellite system, VSAT.

## TEXT BOOKS


1. Wayne, T., (2004). *Advanced Electronic Communications Systems*. 6th Edition, Prentice Hall Publishers. ISBN: 8120324978.
2. Kennedy, G., Davis, B., Prasanna, S R M (2011). *Electronic Communication Sysstems*. 5th Edition, McGraw Hill Education Pvt. Ltd.. ISBN: 978-0-07-107782-8.
3. Prokis, G., Salehi, M.,(2002). *Communication Systems Engineering*, 2nd Edition, Pearson-Always learning, ISBN-13: 9787040169058.
4. Pratt, T., Bostian, C., Allnutt, J., (2006). *Satellite Communications,*2nd Edition, Wiley India, ISBN: 978-8126508334.
5. Roddy, D., (2006). *Satellite Communications*, 4th Edition, Tata McGraw-Hill Education, ISBN: 978-0070077850


## REFERENCE BOOKS


1. Haykin, S., (2001). *Communication System*, 4th Edition, Wiley publications, ISBN 0471178691.
2. Bhattacharya, A., (2017). *Digital Communication*, TMH, ISBN: 9780070591172.
3. Sklar, B., (2009). *Digital Communication* , 2th Edition, Pearson, ISBN: 9788131720929.
4. Rao, P. R.,(2011) *Digital Communication*, TMH, ISBN: 9780070707764.
5. Rappaport,T. S., (2010) *Wireless Communications: Principles and Practice*, 2th Edition, Prentice Hall, ISBN: 978-8131731864.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Principles of Communication System Lab |
| | **COURSE CODE** | 2307221L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307221L.CEO.1: To introduce the students with the fundamental concepts of communication systems.
2307221L.CEO.2: To provide deep insights of analog digital modulation and demodulation techniques.
2307221L.CEO.3: To familiarize students with transmitter and receiver techniques.
2307221L.CEO.4: To make students to examine bit errors and the performance of digital communication system.
2307221L.CEO.5: To provide the exposure of working of wireless communication technologies.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307221L.CO.1: **Implement** the modulation and demodulation schemes for analog and digital communication. [L3]
2307221L.CO.2: **Analyze** the communication system using modern tools. [L4]

**COURSE ABSTRACT:**

This course covers fundamental concepts of communication systems, which are essential for the understanding of advanced courses of analog & digital, wired & wireless communication systems. Beginning with various basic principle as elements of communication system, the course also cover several important analog and digital modulation techniques such as Amplitude Modulation, Frequency Modulation, Phase Modulation, and other passband and baseband modulations. Sampling process and Quatization, including Nyquist criterion and reconstruction of the original signal from the sampled signal will be dealt with in the later parts of the course.The course further address the working principles and prerequisits of advance communication technologies including cellular communication and satellite communication system.This lab course provide hands on communication system analysis using hardware, software and modern tools.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Amplitude Modulation** | **4 HOURS** |
| Investigate classical analog amplitude modulation and the envelope detector (Hardware and/or Software experiment) | | |
| **PRACTICAL NO.02** | **Double Sideband Suppressed Carrier** | **4 HOURS** |
| Generate Double Sideband Suppressed Carrier (Hardware and/or Software experiment) | | |
| **PRACTICAL NO.03** | **Frequency Modulation** | **4 HOURS** |
| Generate and demodulate Frequency Modulated waveform (Hardware and/or Software experiment) | | |
| **PRACTICAL NO.04** | **Amplitude Shift Keying** | **2 HOURS** |
| Transmit and receive ASK signal (Hardware and/or Software experiment) | | |
| **PRACTICAL NO.05** | **Frequency Shift Keying** | **2 HOURS** |
| Transmit and receive FSK signal (Hardware and/or Software experiment) | | |
| **PRACTICAL NO.06** | **Binary Phase Shift Keying** | **2 HOURS** |
| Perform BPSK modulation technique (Hardware and/or Software experiment) | | |
| **PRACTICAL NO.07** | **Quadrature Phase Shift Keying** | **2 HOURS** |
| Perform QPSK modulation technique (Hardware and/or Software experiment) | | |
| **PRACTICAL NO.08** | **Error Performance of any Digital Modulation Scheme** | **2 HOURS** |
| Simulate any digital modulation scheme and analyze its error performance (Software experiment) | | |
| **PRACTICAL NO.09** | **Satellite Link testing with audio tone** | **2 HOURS** |
| Set up and test the satellite communication link using audio tone. | | |
| **PRACTICAL NO.10** | **Equalization** | **2 HOURS** |
| Study of equalization technique to deal with inter symbol interference (Software experiment). | | |

## TEXT BOOKS


1. Wayne, T., (2004). *Advanced Electronic Communications Systems*. 6th Edition, Prentice Hall Publishers. ISBN: 8120324978.
2. Kennedy, G., Davis, B., Prasanna, S R M (2011). *Electronic Communication Sysstems*. 5th Edition, McGraw Hill Education Pvt. Ltd.. ISBN: 978-0-07-107782-8.
3. Prokis, G., Salehi, M.,(2002). *Communication Systems Engineering*, 2nd Edition, Pearson-Always learning, ISBN-13: 9787040169058.
4. Pratt, T., Bostian, C., Allnutt, J., (2006). *Satellite Communications,*2nd Edition, Wiley India, ISBN: 978-8126508334.
5. Roddy, D., (2006). *Satellite Communications*, 4th Edition, Tata McGraw-Hill Education, ISBN: 978-0070077850


## REFERENCE BOOKS


1. Haykin, S., (2001). *Communication System*, 4th Edition, Wiley publications, ISBN 0471178691.
2. Bhattacharya, A., (2017). *Digital Communication*, TMH, ISBN: 9780070591172.
3. Sklar, B., (2009). *Digital Communication* , 2th Edition, Pearson, ISBN: 9788131720929.
4. Rao, P. R.,(2011) *Digital Communication*, TMH, ISBN: 9780070707764.
5. Rappaport,T. S., (2010) *Wireless Communications: Principles and Practice*, 2th Edition, Prentice Hall, ISBN: 978-8131731864.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP) ) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Circuit Theory |
| | **COURSE CODE** | 2307222T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2307222T.CEO.1: To learn the analysis of AC and DC circuits using various techniques.
2307222T.CEO.2: To study time-domain and frequency-domain analysis of RL, RC and RLC circuits.
2307222T.CEO.3: To study the two port networks parameters and relationship.
2307222T.CEO.4: To introduce network related concepts which can be directly related to industry and research applications.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307222T.CO.1: Apply the knowledge of mathematics and physics to the given electrical circuit to obtain the desired parameter [L3].
2307222T.CO.2: Analyze the electrical circuit to obtain the natural and step response [L3].
2307222T.CO.3: Determine two-port network parameters [L3].
2307222T.CO.4: Design the filters for given applications [L4].

**COURSE ABSTRACT:**

Circuit theory is one of the most exciting and dynamic areas of science today with new breakthroughs coming every few years as we piece together a whole new way of looking at the world, a true paradigm shift that is all about connectivity. The study of circuit theory is a highly interdisciplinary field, which has emerged as a major topic of interest in various disciplines ranging from physics and mathematics, to biology and computer science to almost all areas of social science. From the metabolic networks that fuel the cells in our body, to the social networks that shape our lives, networks are everywhere, we see them in the rise of the internet, the flow of global air traffic and in the spread of financial crises, learning to model and design these networks is central to 21st century science and engineering. This is an introductory course where we present topics in a non-mathematical and intuitive form that should not require any specific prior knowledge of science as the course is designed to be accessible to anyone with an interest in the subject.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Circuit Analysis** | **09 HOURS** |

**Contents:** Network concept, Elements and sources, Source transformation, Node and mesh analysis, superposition theorem, Thevenin's theorem, Nortons theorem, reciprocity (AC analysis).
**Self Study:** Series and parallel circuits

| | | |
|---|---|---|
| **UNIT 2** | **Transient response and initial conditions** | **08 HOURS** |

**Applications:** Photoflash unit
**Contents:** Representation of networks by first and second order differential equations. General and particular solution. Time constants and integrating factors. Initial conditions and procedure to evaluate them. Second order equations with internal and external excitation, solution of network equations using Laplace transform.
**Further Readings:** M.E. Van Valkenburg, Network Analysis. 3rd ed., Pearson, 2015. Chapter 5

| | | |
|---|---|---|
| **UNIT 3** | **Two-port network parameters** | **08 HOURS** |

**Case Study:** Transmission lines
**Contents:** Two port parameters, Relationships between two port parameters, transfer function using two port parameters, interconnection of two-ports
**Further Readings:** DRoy Choudhury, Networks and Systems, 2nd ed., New Age Intl., 2015. Chapter 12

| | | |
|---|---|---|
| **UNIT 4** | **Filters** | **08 HOURS** |

**Applications:** Radio Receiver
**Contents:** Filter fundamentals, Low pass, high pass, band pass and band elimination filters. Constant K and M derived sections. Composite filters.
**Further Readings:** John D. Ryder, Networks, Lines and Fields, 2nd ed., Pearson, 2016. Chapter 4

## TEXT BOOKS


1. Robert L. Boylestad. (2014). *Introductory Circuit Analysis*. 12$^{th}$ Edition, Pearson Education. ISBN 9789332518612.
2. Ravish R. Singh. (2019). *Network Analysis And Synthesis*. 2$^{nd}$ Edition, Mc Graw Hill Publication. ISBN 9789353166724.


## REFERENCE BOOKS


1. M. E. Van Valkenburg. (2019). *Network Analysis*. 3$^{rd}$ Edition, Pearson India. ISBN 9789353433123.
2. William Hayt, Jack Kemmerly and Steven Durbin. (2020). *Engineering Circuit Analysis*. 9$^{th}$ Edition, Mc Graw Hill Publication. ISBN 9789390185139.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Circuit Theory Tutorial |
| | **COURSE CODE** | 2307222U |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 1 | NIL | NIL | NIL | NIL | 25 | 25 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307222U.CEO.1: To provide students with a comprehensive understanding of fundamental principles in circuit theory.

2307222U.CEO.2: To enhance students' ability to analyze and solve electrical circuit problems using various established methods.

2307222U.CEO.3: To enable students to apply theoretical knowledge to practical and real-world electrical engineering scenarios.

2307222U.CEO.4: To improve students' critical thinking and problem-solving abilities specific to circuit analysis.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307222U.CO.1: Apply Kirchhoff's Voltage and Current Laws for circuit analysis [L3].

2307222U.CO.2: Utilize methods such as node-voltage, mesh-current, and Thevenin and Norton equivalents for solving circuit problems [L3].

2307222U.CO.3: Analyze the transient and steady-state behavior of RC, RL, and RLC circuits [L4].

2307222U.CO.4: Demonstrate improved problem-solving skills by applying learned techniques to complex circuit problems [L4].

2307222U.CO.5: Design basic electrical circuits to meet specified criteria and test their functionality using simulations or laboratory equipment [L5].

## COURSE ABSTRACT:

Circuit theory is one of the most exciting and dynamic areas of science today with new breakthroughs coming every few years as we piece together a whole new way of looking at the world, a true paradigm shift that is all about connectivity. The study of circuit theory is a highly interdisciplinary field, which has emerged as a major topic of interest in various disciplines ranging from physics and mathematics, to biology and computer science to almost all areas of social science. From the metabolic networks that fuel the cells in our body, to the social networks that shape our lives, networks are everywhere, we see them in the rise of the internet, the flow of global air traffic and in the spread of financial crises, learning to model and design these networks is central to 21st century science and engineering. This is an introductory course where we present topics in a non-mathematical and intuitive form that should not require any specific prior knowledge of science as the course is designed to be accessible to anyone with an interest in the subject.

## TUTORIALS

| | | |
|---|---|---|
| **TUTORIAL NO.01** | **Mesh analysis, node analysis and network theorems** | **3 HOURS** |
| Solving problems on mesh analysis, node analysis and network theorems | | |
| **TUTORIAL NO.02** | **Transient response and initial conditions** | **3 HOURS** |
| Solving problems on transient analysis of RL, RC and RLC circuits. | | |
| **TUTORIAL NO.03** | **Two-port network parameters** | **2 HOURS** |
| Solving problems on two port network parameters. | | |
| **TUTORIAL NO.04** | **Filters** | **4 HOURS** |
| Solving problems on passive filter design. | | |

## TEXT BOOKS


1. Robert L. Boylestad. (2014). *Introductory Circuit Analysis*. 12$^{th}$ Edition, Pearson Education. ISBN 9789332518612.
2. Ravish R. Singh. (2019). *Network Analysis And Synthesis*. 2$^{nd}$ Edition, Mc Graw Hill Publication. ISBN 9789353166724.


## REFERENCE BOOKS


1. M. E. Van Valkenburg. (2019). *Network Analysis*. 3$^{rd}$ Edition, Pearson India. ISBN 9789353433123.
2. William Hayt, Jack Kemmerly and Steven Durbin. (2020). *Engineering Circuit Analysis*. 9$^{th}$ Edition, Mc Graw Hill Publication. ISBN 9789390185139.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Data Structures |
| | **COURSE CODE** | 2307263L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307263L.CEO.1: To illustrate the use of data structures and algorithms.

2307263L.CEO.2: To develop the ability to demonstrate searching sorting algorithms, linear and non linear data structures.

2307263L.CEO.3: To make use of appropriate data structures and algorithms while designing the applications.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307263L.CO.1: Apply the concepts of data structures that effectively model the information in the problem. [L3]

2307263L.CO.2: Develop solutions for the real world problems using linear and non linear data structures. [L3]

2307263L.CO.3: Design a management system for given application as a member of team and make an effective oral presentation.[L6]

**COURSE ABSTRACT:**

Data Structure is the mechanism by which you can store data in a computer system. It allows an application to fetch and store data in the computers memory in an efficient manner. It is very important to identify and select the correct type of data structure for particular application. We are exploring the different types of data structures and learn how to implement them to solve real world problems. The inclusion of Challenging Problems in the course will enhance students logical thinking and boost their analytical skills. This course will improve students problem solving abilities and coding skills.

**CONTENTS:**

Revision of C / C++ concepts , Array , Structures , need of searching , searching techniques , sorting techniques , database management system , dynamic memory allocation , Single Variable Polynomial, Representation using arrays, Polynomial as array of structure, Polynomial addition , Linked list , types , various operations on linked list , stack , application of stacks , expression conversion using stack , Queue , types , application , tree as non linear data structure , terminologies , types , implementation.
**Self Study:** Decision making statements , Loops , Functions , Class , object , constructor.

**PRACTICALS:** All assignments should be performed considering real world applications.

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Searching Techniques** | **4 HOURS** |

Consider a student database of SY BTECH class (at least 10 records). Database contains different fields of student like Roll No, Name and SGPA.(array of structure)

1. Search students according to SGPA. If more than one student having same SGPA, then print list of all students having same SGPA. (Use Linear Search)
2. Search a particular student according to name using binary search.

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Sorting Techniques** | **4 HOURS** |

Considering the real time applications,

1. Design a roll call list, arrange list of students according to roll numbers in ascending order (Use Bubble Sort)
2. Arrange list of students alphabetically. (Use Selection sort)
3. Arrange list of students to find out first ten toppers from a class. (Use Insertion sort).

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Database Management System** | **4 HOURS** |

Design and implement a program to read, display, insert, update and delete operations on data Objects using array of structure for the following application.

- Customer Management System

| PRACTICAL NO.04 | Linked List Representation | 6 HOURS |
|---|---|---|
| Design and develop program for insertion, updating, searching, sorting and deletion operations using singly linked list for the following application<br>• Placement Information System | | |
| **PRACTICAL NO.05** | **Polynomial Addition** | **4 HOURS** |
| Design and develop a program for polynomial addition operations using singly linked list. | | |
| **PRACTICAL NO.06** | **Stack** | **4 HOURS** |
| Design and develop a program for stack data structure using array. | | |
| **PRACTICAL NO.07** | **Postfix Evaluation** | **4 HOURS** |
| Implement a program for following using stack<br>• Postfix Evaluation | | |
| **PRACTICAL NO.08** | **Linear Queue** | **4 HOURS** |
| Design and develop a program for linear queue data structure using array. | | |
| **PRACTICAL NO.09** | **Circular Queue** | **4 HOURS** |
| Pizza parlor accepting maximum M orders. Orders are served in first come first served basis. Order once placed cannot be cancelled. Write a program to simulate the system using circular queue using array. | | |
| **PRACTICAL NO.10** | **Non Linear Data Structure** | **6 HOURS** |
| Implementation and Operations on Binary Search Tree - Create, Insert, Delete, Tree traversals preorder, in order, postorder ( recursive implementation) | | |

**EXAMINATION SCHEME**

Quizzes, Activities and Continuous Assessment: 20 Marks
Data Structure Mini Project: 15 Marks
End Semester Practical Examination based on all practicals : 40 Marks

## TEXT BOOKS


1. Seymour Lipschutz, Data Structure with C, Schaums Outlines, Tata McGrawHill , 4th Edition , ( ISBN 13 : 978-1259029967 ).
2. E. Horowitz , S.Sahani, S.Anderson-Freed , Fundamentals of Data Structures in C, Universities Press , , ( ISBN-10 : 8173716056 )
3. Yashavant Kanetkar, Data Structures Through C, BPB Publication, 2nd Edition (ISBN-13: 978-8176567060).
4. E. Balgurusawmy. (2020). Object Oriented Programming with C++. 8th Edition, McGraw Hill Publishers. ISBN 9389949181.
5. E. Horowitz S. Sahani, D. Mehta, Fundamentals of Data Structures in C++ , Seventh Edition,Universities Press ,2008, ISBN-13: 978-8173716065.


## REFERENCE BOOKS


1. D. P Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum, Data structures using C, Pearson India , 2nd Edition (ISBN-: 978-8131702291).
2. S.K. Srivastav, Deepali Srivastav, Data Structure Through C, BPB Publication , 2nd Edition, (ISBN-13: 978-8176567411).
3. Richard F. Gilberg, Behrouz A Forouzan, Data structures- A pseudocode Approach with C++ Second edition , Cengage l earning, 2004, 9780534390808.
4. E. Horowitzs S. Sahani, S. Rajashekharan, Fundametals of Computer Algorithm s, Universities Press, 2008,ISBN-13: 978-8 173716126
5. Debasis Samanta, Classic Data Structures, Second Edition, TMH, 2009, ISBN-13: 978-8120337312

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2027 - 2028 (NEP Rev. 2023) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Engineering Informatics |
| | **COURSE CODE** | 2301232T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301232T.CEO.1: To introduce facts, concept and theory of an information system.

2301232T.CEO.2: To understand importance of Data collection and data analysis for system implementation.

2301232T.CEO.3: To understand Data presentation and effective communication and storage for a system.

2301232T.CEO.4: To make aware about the importance of Engineering Design and Innovative business.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2301232T.CO.1: Identify data collection, processing, and analysis techniques for various systems in the real life applications[L3].

2301232T.CO.2: Develop Data Acquisition System for Collect, store, and manage large sets of engineering data, ensuring data integrity and accessibility for analysis based on the real life application[L3].

2301232T.CO.3: Analyze communication modes and storage techniques for data transmission and reception for data acquisition system[L4].

2301232T.CO.4: Analyze real time application and develop a Engineering design to grow in business. [L4].

## COURSE ABSTRACT:

Engineering Informatics is the course focusing soft skill development of students like decision making, analysis and presenting the information in effective manner. As per the industry demand automation is one of the important area to focus, decision making using automated machine interference is crucial in industry 4.0. To make strong decision making process, it is necessary to collect the data base, obtain the correct information, covert it into knowledge and visualize it using human and machine interface. This process must follow the information life cycle and its stages. The journey to make decision is explained and demonstrated in the course. Course contents also focus on recent development in the sector of green sustainability, Infrastructure and Sustainability, Artificial Intelligence (AI) and Machine Learning (ML), Data Science, Cloud Computing, Healthcare and Block-chain Technologies, Generative AI, Robotics, Business, Entrepreneurship and Engineering Design functioning and real time project implementation is the integral part of this curriculum. The course emphasizes adaptability, critical thinking, and keeping up with emerging trends in the fast-evolving field of technology as a life long learning.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Fundamentals of Data Collection and Analysis** | **08 HOURS** |

**Applications/Case Study:** Retail operations with minimized footprint

**Contents:** Overview of data and its types, Data survey and data segregation in various types. Importance of green sustainability, Infrastructure and Sustainability. Introduction to Eco-friendly product life-cycle. Information Life Cycle - Types of Information System - Transaction Processing System, Management Information System, Decision Support System. Application discussion - Eco-friendly public transport.

**Further Readings:** Energy-efficient products and materials. Vertical forest buildings.

| | | |
|---|---|---|
| **UNIT 2** | **Information Collection and Processing** | **07 HOURS** |

**Applications/Case Study:** Remote patient monitoring system and Data-driven precision agriculture system.

**Contents:** Data Acquisition system, Data Collection Methods: Human Interface [ Interview, Interrogation, Survey and Observation ] Hardware Interface [ Digital Data Acquisition System ] Software interface [ Web scrapper ] Data Processing Cycle & Data Processing Stages Design of Experiment.

**Further Readings:** AI-based music recommendations and Predicting customer needs.

| | | |
|---|---|---|
| **UNIT 3** | **Data Storage, Transmission, Security, Analysis** | **07 HOURS** |

**Applications/Case Study:** Real-time stock prediction.

**Contents:** Cloud-based file sharing and backup, Introduction to data transmission, transmission modes, Data storage. Data security and privacy : Encryption & Decryption Data Analysis: Blockchain for secure trade financing. Rights management for artists, business and property - Introduction.

**Further Readings:** Authenticity and provenance tracking.

| UNIT 4 | Innovative Business and Engineering Design | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Automated EV manufacturing

**Contents:** Building a customer-centric culture, Empowering entrepreneurs with e-commerce solutions. Industrial design and user experience innovation. Iconic ergonomic design for branding. Effective product differentiation and marketing. Generative AI assistant, voice assistant, Chatbot - For business model

**Further Readings:** Sustainable design with customer satisfaction. Siri business model.

## TEXT BOOKS


1. Ralph M Stair, George W Reynolds. (2022). *Fundamentals of Information Systems.*. 6th Edition, McGraw Hill Publishers. ISBN 9781423925811.
2. Benny Raphael, Ian F. C. Smith. (2017). *Engineering Informatics: Fundamentals of Computer Aided Engineering*. 2nd Edition, Wiley-Blackwell. ISBN 9781119953418.


## REFERENCE BOOKS


1. Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., Wallace, K., & Blessing, L. (2022). *Engineering Design: A Systematic Approach*. 1st Edition, Springer, Auerbach Publications. ISBN: 978-1846283185..
2. Adrian McEwen, Hakim Cassimally (2023). *An Designing the Internet of Things*. 7th Edition, Wiley Publication. ISBN 9781118430620.


## e - Content

1. https://youtu.be/zQS8siOoiu8
2. https://youtu.be/9ce1FbFO/YQ?list=PLFW6lRTa1g80R3Q/5-jsNVhDFAeGaABo9

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2027 - 2028 (NEP Rev. 2023) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Engineering Informatics Lab |
| | **COURSE CODE** | 2301232L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301232L.CEO.1: To introduce facts, concept and Implementation of DAS of an information system.
2301232L.CEO.2: To understand evolution of an information system.
2301232L.CEO.3: To make aware about IoT based information system.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2301232L.CO.1: Design and Develop an Automation System using Simulation Software [l4]
2301232L.CO.2: Develop Data Visualization Techniques for effective communication of information for professional dashboard design[L5].
2301232L.CO.3: Design and Development of an Automation System using Microcontroller / Microprocessor [l5]

**COURSE ABSTRACT:**

Engineering Informatics is the course focusing soft skill development of students like decision making, analysis and presenting the information in effective manner. As per the industry demand automation is one of the important area to focus, decision making using automated machine interference is crucial in industry 4.0. To make strong decision making process, it is necessary to collect the data base, obtain the correct information, covert it into knowledge and visualize it using human and machine interface. This process must follow the information life cycle and its stages. The journey to make decision is explained and demonstrated in the course. Course contents also focus on recent development in the sector of green sustainability, Infrastructure and Sustainability, Artificial Intelligence (AI) and Machine Learning (ML), Data Science, Cloud Computing, Healthcare and Block-chain Technologies, Generative AI, Robotics, Business, Entrepreneurship and Engineering Design functioning and real time project implementation is the integral part of this curriculum. The course emphasizes adaptability, critical thinking, and keeping up with emerging trends in the fast-evolving field of technology as a life long learning.

**PRACTICALS**

| **PRACTICAL NO.01** | **Simulation of IoT Systems** | **6 HOURS** |
|---|---|---|

Deploy an IoT based automation system for controlling various appliances such as fan, lights, water pumps etc.

A.1: Identify the home appliances that require human interaction for its operations.
A.2: State the need of automation.
A.3: Identify system component.
A.4: Design circuit diagram.
A.5: Assemble system components.
A.6: Program the interface.
A.7: System Testing.

| **PRACTICAL NO.02** | **Data Acquisition , Storage and Retrieval Systems using Arduino / Raspberry Pi** | **12 HOURS** |
|---|---|---|

Deploy an IoT based automation system in the sector of Smart Agriculture, Smart Home Automation, Smart City, Disaster management, Military applications, Industrial automation etc and develop a IoT based system which will include following,

A.1: Identification of an interdependent elementary data items which have facts and figures.
A.2: Design circuit diagram.
A.3: Data collection through sensors.
A.4: Processing using Arduino / Node MCU A.5: Data Storage on cloud through Thinkspeak.
A.6: Device control using mobile Apps or through Web pages.
A.7: Data storage in file format.

| PRACTICAL NO.03 | Data Presentation & Visualization | 10 HOURS |
|---|---|---|

Identify the data set containing thousands of records related to Smart Agriculture, Smart Home Automation, Smart City, Disaster management, Military applications, Industrial automation etc and develop a system to represent and visualize the data professionally. Make use of open source software tool like, OpenHAB, Power BI, Jupyter Notebook etc. Prepare the Dash Board by following given steps,

A.1: Data selection for presentation and visualization.

A.2: Selection of appropriate data presentation format, graphs.

A.3: Selection of Software tool.

A.4: Preparation of Dash Board for selected data.

A.5: Demonstration of Data presentation & Visualization.

## TEXT BOOKS


1. Ralph M Stair, George W Reynolds. (2016). *Fundamentals of Information Systems.*. 6th Edition, McGraw Hill Publishers. ISBN 9781423925811.
2. Benny Raphael, Ian F. C. Smith. (2017). *Engineering Informatics: Fundamentals of Computer Aided Engineering*. 2nd Edition, Wiley-Blackwell. ISBN 9781119953418.


## REFERENCE BOOKS


1. Gerard Jounghyun Kim. (2022). *Human Computer Interaction: Fundamentals and Practice.*. 1st Edition, CRC Press, Auerbach Publications. ISBN 9781482233896.
2. Adrian McEwen, Hakim Cassimally (2023). *An Designing the Internet of Things*. 7th Edition, Wiley Publication. ISBN 9781118430620.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: 2027 - 2028 (NEP Rev. 2023) |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Entrepreneurship Skills |
| | COURSE CODE | 2301276 |
| | COURSE CREDITS | 2 |
| RELEASE DATE : -- | REVISION NO. | NEP 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | 2 | Nil | Nil | 25 | 20 | 30 | 75 |

PREREQUISITE: Nil

## COURSE OBJECTIVES :

2301276.CEO.1: To create awareness regarding entrepreneurship and encourage for selecting entrepreneurship as career option.
2301276.CEO.2: To provide exposure to the philosophies used in startup culture.
2301276.CEO.3: To introduce a basic pathway to become an entrepreneur.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2301276.CO.1: Prepare a venture concept by identifying a problem /opportunity through survey [L3].
2301276.CO.2: Devise a value preposition canvas [L4].
2301276.CO.3: Propose a minimum viable product [L5].
2301276.CO.4: Demonstrate the balance sheet estimation for venture [L3].

| COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **Building Entrepreneurial mindset** | **6 HOURS** |
| Skills required for entrepreneurs, Common misconceptions about entrepreneurship, Dealing with Ambiguity, team formation.<br>**Self study**: Technology readiness levels systems. | | |
| **UNIT 2** | **Problem Identification and Opportunity Discovery** | **8 HOURS** |
| Analysis of different aspects of the venture concept, Revisiting the Problem Statement, Calibrate the Problem Statement on the 'Great Problem Litmus Test', composing the Problem Pitch.<br>**Case Study**: Desi Hangover-the shoe story.<br>**Assessment Activity**: Milestone 1 - Create a Value Proposition Canvas tat describes the venture concept and addresses a specific problem/ opportunity [CO1]. | | |
| **UNIT 3** | **Customer and Markets** | **7 HOURS** |
| Market Identification, Customer segmentation, Carving a Niche for identified opportunity, Market sizing, creating a Customer Persona.<br>**Case Study:** Verloop's story on customer acquisition and growth marketing strategies.<br>**Home assignments:**<br>1. Craft your value proposition .<br>2. Create a Value Proposition Canvas.<br>3. Create a sustainable differentiation strategy. | | |
| **UNIT 4** | **Competitive Advantage** | **6 HOURS** |
| Concept of competition, collecting information about the competition, running a competitive analysis, categories of competition, contribution of the competition in the company's success.<br>**Case Study:** How Inzpira personalized communicative English training with a competitive advantage approach.<br>**Assessment Activity**: Milestone 2 - Build the Lean canvas and create MVP version/s Proposing a minimum viable product[CO2, CO3]. | | |
| **UNIT 5** | **Business model and MVP** | **6 HOURS** |
| Business model and the existing types, selection of business model suitable for the venture, Building the Lean canvas, Creating a Minimum Viable Product, Test the MLP.<br>**Case Study:** The Story of Knorish- How did India's Leading Course Creator Platform Build Its MVP.<br>**Home assignments:** Build the Lean canvas and create MVP version/s.<br>**Assessment Activity**: Milestone 3 - Presentation on financial planning and forecasting that estimates the balance sheet of the venture [CO4]. | | |

| UNIT 6 | Financial Feasibility and building brand in the market | 6 HOURS |
|---|---|---|

Financial planning, Components of a financial plan, Building financial plan and projections, Building the Go-To-Market strategy, Building and Positioning the brand, digital marketing plan.

**Case Study:**

1. How Bodh Gems and Crystals managed and tracked their costs to transform their passion into a profit-making business.
2. How Data Sutram piggybacked on the right channels to scale their business Next Generation Entrepreneur.

**Home assignment:** Presentation on financial planning and forecasting.

| UNIT 7 | Managing growth and funding strategy | 6 HOURS |
|---|---|---|

Devising a Growth Plan, Structure the Scaling Strategy, Devise a Customer acquisition strategy, Monitor KPIs and enhance Productivity via Process improvements, Operational Excellence, and Managing Sales Distribution, Identifying funding sources, Mapping Start-Up Cycle to Funding Options, Creating business valuation.

**Case Study:**

1. Torchit's social entrepreneurship brought in a revolution and impacted millions of lives.
2. Growing at 100x with 100X.VC The Art of Fundraising Home assignment: Presentation on growth and funding strategy ur.

**Assessment Activity**: Milestone 4 - Presentation on growth and funding strategy [CO4].

## REFERENCE BOOKS


1. Masters, B., Thiel, P. (2014). *Zero to one: notes on start ups, or how to build the future*. Random House.
2. Ferriss, T. (2017). *Tools of titans: The tactics, routines, and habits of billionaires, icons, and world-class performers.* Houghton Mifflin.
3. Lyons, D. (2016). Disrupted: My misadventure in the start-up bubble. Hachette UK.
4. Robbins, A., *Robbins, T., and Mallouk, P. (2017). Unshakeable: Your Financial Freedom Playbook*. Simon and Schuster.
5. Hansson, D. H., and Fried, J. (2010). *ReWork: Change the Way You Work Forever.* Random House.
6. Financial Management; *Text and Problems, 7th Ed., A Khan and P. K. Jain, Tata MacGraw Hill,* , 44th ISBN: 9789353162184.
7. Kapal, R. (2018). *Kites in a Hurricane: Startups from Cradle to Fame.* Sage Publications Pvt. Limited.
8. Koontz, H., O'Donnell, C., *Weihrich, H. (1986). Essentials of management (Vol. 18).* New York: McGraw-Hill.
9. Prasanna, C. (2001). *Financial Management Theory and Practice. Tata McGraw.* Tata MacGraw Hill.

**E-RESOURCES**

1. Wadhwani Foundation - https://wadhwanifoundation.org/
2. Startup India Learning Program - https://www.startupindia.gov.in/content/sih/en/learning-and-development$_v$2.*html*

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Environmental Science |
| | **COURSE CODE** | 2301286T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301286T.CEO.1: To study a fundamental and ecological concept of environment.

2301286T.CEO.2: To enable students to have a nuanced understanding of environmental pollution, solid waste management and climate change and to act with concern on environmental issues.

2301286T.CEO.3: To develop a sense of responsibility towards society and the environment.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2301286T.CO.1: Demonstrate the importance of ecosystem and biodiversity for maintaining ecological balance [L3].

2301286T.CO.2: Identify different types of environmental problems and their control measures [L3].

2301286T.CO.3: Apply environmental legislation and sustainable development concept [L3].

**COURSE ABSTRACT:**

This course provides an overview of the significance of ecosystems, including environmental pollution, biodiversity and its conservation, and environmental law. Discussions of environmental issues begin with climate change, global warming, and other environmental challenges. A model for the generation of Power as Solar, Wind, and Water is required for students as part of the Green Energy Corridor Project creative exercise. Students will do a brief project on any environmental idea to help them build a positive attitude towards the environment, such as the reuse, recycle, and reduce principle, environmental pollution monitoring and control, the material balance principle, sustainable development, or environmental innovations.

**THEORY**

| **UNIT 1** | **Overview of Environment: Field Study (Minimum 2)** | **06 HOURS** |
|---|---|---|

**Theory Content**: Concept of Ecology and Environmental Science, Biogeochemical cycle, Ecosystem and its management. Fate of Environmental Pollutant, Environmental status, Effect on climate change.

**Student will present in the following stages for the activities.**

Stage I Inception (2 Hours)

Stage II Data Collection (2 Hours)

Stage III Analysis (2 Hours)

**Activity No: 1 (Group activity includes, only 5 members, Geo-tag photos, Detailed site visit report)**

Students have to visit any one nonhazardous polluted site for finding the various reasons of its pollution and suggest preventive measures for it.

Non Hazardous Site includes any of the following place:

River

Solid Waste Treatment Plant

Garbage collection points

Industries

Site which comes under either of Soil, Water, Air or Industrial pollution

Visit report must content Geotag Photos and detailed site visit record. Visit can be done in a group up to 4 members only.

**Activity No: 2 (Individual activity)**

To describe the climate of an urban area by analyzing hourly variation of NCAP(National Clean Air Program) acclaimed Pollutant in the same area.

**Activity No: 3(Group activity)**

Environmental awareness programs under Swatch Bharat Mission like, Sachet Hi Sews, Swachhta pakhwada, Special Drive before Diwali, organizing essay competition, poster competition, slogan making competition, Awareness about minimum electricity consumption in campus, Celebrating various Environmental Days.

| UNIT 2 | Environmental Pollution (Minimum 3) | 08 HOURS |
|---|---|---|

**Theory Content**: Environmental Pollution: Air, Water, Soil, Solid and Hazardous Waste Management; Environment and human health, Over utilization of natural resources, Environmental Legislation, Environmental monitoring organizations in India, Environmental Protection Agency (EPA).

**Activities:**

1) Activity No. 1 Determination of PH and Electrical Conductivity of Water Sample.
2) Activity No. 2 Segregation of waste from source. (Visit to garbage segregation disposal site)
3) Activity No. 3 Measurement of noise using sound level meter.
4) Activity No. 4 Study of soil property, Temperature, Texture and Particle Size.

| UNIT 3 | Creative Exercise : Global Environmental Issues (Any One) | 08 HOURS |
|---|---|---|

**Theory Content**: Introduction to climate change, Global warming, Acid rain, Ozone layer depletion, Plastic waste management, Municipal solid waste management, Food problem, E-waste management, Social Issues: Environmental ethics and economics. (This content is for reference during practical)

**Creative Activities:**

1) The Green Energy Corridor Project Develop lab working model alternatives to renewable energy sources like solar, wind, and water for the production of power.
2) Use of social media platform for E networking and Dissemination of ideas on Environmental Issues.
3) Study of 8 National Missions on climate change as per National Action Plan on Climate Change (NAPCC), GOI.
4) Make a report on UN Goals on sustainability and also different effective measures were taken for the Conservation of Rivers in India.

| UNIT 4 | Project Work (Compulsory) | 08 HOURS |
|---|---|---|

**Project work Description:**

Students have to identify the real life environmental problems from their daily observations and try to find out the various feasible solutions for it as their project work. They are supposed to prepare the prototype, demonstration model, detailed report and present it to the evaluators. The project topic should be related to the below mentioned heads:

1) Reduce, Reuse, Recycle.
2) Environmental Pollution Monitoring and Control Material Balance Concept.
3) Sustainable Development.
4) Environmental Innovations.

The evaluation is based on at least one number of project presentation reviews apart from the final project presentation.

Participation and Certification of Student groups into Any International/National/State/Regional Level competition organized by any Government/Private Agency, NGOs, Consultancy related to Environmental Concerns.

**Rubrics for evaluation of 40 marks, of project-based learning.**

| Month Of Assessment | Assessment task | Marks |
|---|---|---|
| 1 st month | Group of 4 Members Defining objectives methodologies literature review | 10 marks |
| 2 nd month | Model development Poster making | 10 marks |
| 3 rd month | Report preparation and Plagiarism | 10 marks |
| 4 th month | Final presentation | 10 marks |

## TEXT BOOKS


1. Rao, C. S. (2007). Environmental pollution control engineering. New Age International.
2. UNIVER ITy, R. M. B. Tech.(Full Time) Food Process Engineering Curriculum & yllabus.
3. Sharma, T., Litoria, P. K., Bajwa, B. S., & Kaur, I. (2021). Appraisal of groundwater quality and associated risks in Mansa district (Punjab, India). Environmental Monitoring and Assessment, 193, 1-21.
4. Unit, V. Population explosion in India, Chinathe present and future scenario. 9 Hours Total: 45 Hours Textbooks 1. TG Jr. Miller, Environmental Science, Wadsworth Publishing Co., 2004. B. TECH. INFORMATION TECHNOLOGY (Minimum Credits to be earned: 193) First Semester Code No.
5. Metcalf, L., Eddy, H. P., & Tchobanoglous, G. (1991). Wastewater engineering: treatment, disposal, and reuse (Vol. 4). New York: McGraw-Hill.


## REFERENCE BOOKS


1. Coronel, C., and Morris, S. (2016). Database systems: design, implementation, and management. Cengage Learning.
2. Rotabi, K. S. (2005). Theory bridging between sociology, social work and ecology. Dynamic interchanges and cross-fertilizations: The intellectual legacy of the Odum family. The University of North Carolina at Chapel Hill.
3. Peavy, H. S., Rowe, D. R., & Tchobanoglous, G. (1985). Environmental engineering (Vol. 2985). New York: McGraw-Hill.
4. Nagar, S. R. M., & District, K. K. Bachelor of Technology (B. Tech.) in Civil Engineering.
5. Henry, J. G., Heinke, G. W., & Burton, I. (1996). Environmental science and engineering (Vol. 445, No. 452, pp. 456-457). Upper Saddle River, NJ: Prentice Hall.
6. Mayer, R. H. (2000, June). A Compendium on Environmental Engineering for Ocean Engineering Majors. In 2000 Annual Conference (pp. 5-16).

**E-RESOURCES LINKS**

1. SCIENCE DIRECT- https://www.sciencedirect.com/referencework/9780124095489/earth-systems-and-environmental-sciences
2. UNISCO- https://www.unesco.org/en/climate-changE
3. UN GOALS- https://sdgs.un.org/goals
4. NPTEL COURSE -https://archive.nptel.ac.in/courses/127/105/127105018/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (NEP Rev. 2023) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Project Implementation |
| | **COURSE CODE** | 2307292L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE:** Knowledge of engineering fundamentals.

**COURSE OBJECTIVES :**

2307292L.CEO.1: To develop a sense of curiosity and critical thinking approach for implementing the solutions to the real world problems.

2307292L.CEO.2: To disseminate the project implementation techniques / methodological approaches to propose solution to the real world problems.

2307292L.CEO.3: To cognize the ethical principles, standard engineering practices in general and its importance in project implementation, documentation and ethical writing.

2307292L.CEO.4: To develop a sense of responsibility while working in a team and practice professional ethics.

2307292L.CEO.5: To disseminate the importance of Intellectual property rights, writing the research articles and publication.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2307292L.CO.1: Demonstrate an ability to apply discipline specific modern project management tools, techniques and resources to solve the real world project problem [L3].

2307292L.CO.2: Implement feasible solutions using scientific principles and considering the socio-economic, sustainability factors for solving real world problems [L3].

2307292L.CO.3: Apply the knowledge of professional ethics and standard engineering practices for project implementation, testing and documentation [L3].

2307292L.CO.4: Demonstrate an ability to adhere to the professional ethics and behave responsibly as an indiuvual and in a team and present the concepts/ prototypes/ models during the project demonstration [L3].

2307292L.CO.5: Demonstrate an ability to prepare research article, Intellectual property rights [L3].

## COURSE ABSTRACT

Field project is an avenue to cater Societal and Industrial needs. Project implementation is one of the course where students will try to solve real time engineering problems. This course focuses on Selection and application of state or art technologies/ methods/engineering tools/software/analytical techniques for comparing and providing the feasible solution. Further it emphasizes on the importance of socio-economic and sustainability factors while implementing the final solution. Through this course students learn to implement the engineering fundamental concepts, get practical experience, get the chance to showcase skills, learn about team work, communication skills and responsibilities, professional behaviour. It also imparts knowledge of standard engineering practices and Intellectual Property Rights.

## Guidelines

Preferably project team students of Sem III would be continued in this semester IV. Every project team should consist of minimum 03 and maximum of 04 students. The team members may be from different programs to support the interdisciplinary and / or multidisciplinary functioning.

1. Team members should deliberate upon different methodical approaches and finalize the appropriate method.
2. Students project team should explore different Engineering tools/techniques for providing the problem specific solution.
3. Justify the selected method/Engineering tools/analytical techniques identified based on the feasibility, affordability and ease of use.
4. To implement the solution ,it is imperative to take inputs/suggestions from various stake holders.
5. Solution must be critically analyzed from various engineering and social aspects.
6. Completed solution must be pilot tested from the target user/stake holders.
7. Students need to protect their innovation,proof of concept through IPR.
8. While working in a team, individual student should contribute and communicate effectively to maintain team balance.
9. Learn and apply standard engineering practices and professional ethics.
10. Adherence to the principles of ethics, code of conduct and standard engineering practices is required.

**TIMELINE**

The THREE member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Presentation of Project Review -1- Phase-I : Implementation / development of the project. 3 Weeks (1st -3rd week)
2. Presentation of Project Review -2 - Phase -II : Project implementation and testing.: 3 weeks (4rd- 6th week)
3. IPR Activity on earlier selected project problem : 2 Weeks (7th-8th week)
4. Preparation of Project Progress Report (week 9th and 10th)
5. Project Documentation ( 11th week) (Assessment by project Guide)
6. Submission of the final project copy to the project guide. ( 12th week)
7. Evaluation by external examiner ( End Semester by 13th, 14th week)

**Project Demonstration (50 Marks)**

1. **Review 1 (Project Implementation) (05 marks)**
   - Use appropriate procedures, modern tools and techniques to conduct experiments and collect data, represent in tabular/ graphical form and draw valid conclusions.
   - Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem and Verify the credibility of results.
2. **Review 2 (Project Demonstration) (10 marks)**
   - Demonstrate proficiency in using discipline specific modern tools/ techniques to solve the project problem.
   - Demonstrate an ability to describe engineering roles in a broader context, pertaining to the environment, safety, public welfare.
3. **Project Activities (05 Marks)**
   - Demonstrate an ability to prepare and publish research article.
   - Demonstrate an ability to write a Patent Draft, file IPR.
4. **Project Documentation (10 marks)**
   - Produce clear, well-constructed, and well-supported written engineering documents, project cost sheet and plagiarism report.
5. **Final project demonstration & Project team presentation (20 marks)**
   - Demonstrate effective communication,Implement the norms of standard professional practices, Present results as a team showing the responsible behaviour.

## TEXT BOOKS


1. Schmidt, T. (2009). Strategic Project Management Made Simple. 2nd Edition, Wiley Pub, India.ISBN 978-1-119-71817-8
2. Challender, J. (2022). Professional Ethics in Construction and Engineering, Wiley .ISBN-13: 978-1-119-83210-2
3. Rogerson, S. (2003). Computer Ethics and Professional Responsibility. 1st Edition Wiley Blackwell Publication.ISBN-13: 978-1855548459
4. Nagarazan, R.S. (2022). A Textbook on Professional Ethics and Human Values. New Age Publication, ISBN-13: 978-81-224-2301-3
5. Hering, L. and Hering H. (2005). How to write Technical Reports. Springer ISBN : 978-3-540-69929-3
6. Tewari, R. and Bhardwaj, M. (2021).Intellectual Property A Primer for Academia. Publication Bureau, Panjab University Chandigarh ISBN: 81-85322-92-9


## REFERENCE BOOKS


1. Zwikael, O. and Smyrk, J. (2019). Project Management A Benefit Realization Approach. Springer Publication, ISBN-13: 978- 0134877693
2. Handley, W. (1977). Industrial Safety Handbook. 2nd Revised edition ,McGraw-Hill Companies;, ISBN-13: 978-0070844810
3. Mislick, G. and Mussbaum, D. (2015) Cost Estimation: Methods and Tools. Wiley, ISBN-13: 978-1-118-53613-1
4. Chilcutt, A. and Adam, J. (2019). Engineered to Speak: Helping You to Create and Deliver Engaging Technical Presentations. Wiley, ISBN-13: 978-1-119-47496-8


## E-CONTENTS/VIRTUAL LAB/ONLINE SIMULATOR LINKS

1. University of California, free online course: https://www.classcentral.com/course/project-planning-1-12208
2. International Journal of Project Management : https://www.sciencedirect.com/journal/international-journal-of-project-management
3. Procedia- Social and Behavioral Sciences Open access journal: https://www.sciencedirect.com/journal/procedia-social-and-behavioral-sciences
4. Free software tool for project Management : https://onlinepmcourses.com/project-management-tools/free-project-management-resources/
5. Research Article:https://doi.org/10.1016/j.sbspro.2012.12.210
6. Research Article: https://doi.org/10.1016/j.tsc.2024.101477
7. Research Article: https://doi.org/10.1016/j.ijproman.2024.102584

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Internship (Life and Soft Skills) |
| | **COURSE CODE** | 2307296L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | TUTORIAL/ | PRESENTATION/ | TOTAL |
| LECTURE | PRACTICAL | ICE | ECE | IA | CA | DEMONSTRATION | |
| NIL | NIL | NIL | NIL | NIL | 30 | 45 | 75 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2307296L.CEO.1: To enhance technical skills and self-directed learning.

2307296L.CEO.2: To develop adaptability and resilience in a multicultural or professional environment.

2307296L.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2307296L.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2307296L.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2307296L.CO.1: Utilize online learning platforms effectively to acquire technical skills and engage in lifelong learning [L3].

2307296L.CO.2: Apply professional behavioral practices, including teamwork, time management, and ethical decision-making, in diverse settings [L3].

2307296L.CO.3: Reflect on and evaluate personal growth and adaptability through experiential learning and living experiences [L4].

2307296L.CO.4: Analyze emerging industry trends and develop actionable strategies to meet professional and career-related goals [L4].

2307296L.CO.5: Formulate well-defined problem statements by critically examining real-world challenges and proposing innovative approaches [L4].

2307296L.CO.6: Demonstrate effective communication skills by preparing and delivering professional presentations and writing clear, concise reports [L5].

**INTRODUCTION:**

This internship is designed to equip first-year B.Tech. students with essential skills for personal and professional growth. The program focuses on cultivating professionalism and life skills, enabling students to enhance their technical and soft skills in todays competitive landscape. Through this experience, students will develop a comprehensive skill set, including emotional intelligence, effective communication, teamwork, and sportsmanship. Additionally, the course encourages active participation in co-curricular and extracurricular activities, fostering resilience, adaptability, and a collaborative spirit. By completing this internship, students will establish a solid foundation for academic success and career readiness.

## SCOPE AND STRUCTURE OF SIP:

**Scope** The Student Internship Program in Life and Soft Skills is designed for students entering the second year of the B.Tech. program, to be undertaken during the summer break after Semester II. This program aims to provide opportunities for skill enhancement through life skills development, technical skills training, or industrial exposure. The internship focuses on helping students identify and engage with relevant learning platforms, small-scale industries, or training opportunities to build competencies essential for personal and professional growth. The program emphasizes cultivating life skills, such as effective communication, teamwork, emotional intelligence, and adaptability, alongside fostering technical expertise.

**Structure**

Duration: 3 to 4 weeks (minimum of 100 hours).

Timeframe: Conducted during June-July of each academic year.

Nature of Internship:

1. Life skills development courses.
2. Technical skills training programs.
3. Industrial training with companies or small-scale industries.

Facilitation: MITAoE assists students in identifying and applying for appropriate internships aligned with the programs goals.

Mentorship: Each first-year student will be assigned their first-year mentor as their internship guide. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :** The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development.

**Student Development Focus :** Before selecting an internship option, students are required to identify specific areas of self-development they wish to enhance. This may include life skills (e.g., communication, leadership, emotional intelligence), technical competencies, or professional abilities.

Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT SCHEME:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

**1. Biweekly Progress Reports (40 percent) :**

a) Students must submit a minimum of two progress reports during the internship period.

b) These reports will document the students activities, achievements, and challenges.

c) The reports will be reviewed and evaluated by the assigned first-year mentor.

**2. Detailed Project Report with Learning Outcomes (40 percent) :**

a) Upon completion of the internship, students are required to submit a detailed project report.

b) The report should highlight the activities undertaken, skills acquired, challenges addressed, and overall learning outcomes.

**3. Final Presentation with Certificate (20 percent) :**

a) Students will deliver a final presentation summarizing their internship experience and learning outcomes.

b) A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2027 - 2028 (Rev. 2023 (NEP)) |
| **SECOND YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Indian Constitution |
| | **COURSE CODE** | 2301281A |
| | **COURSE CREDITS** | (Audit Course) |
| **RELEASE DATE : --** | **REVISION NO** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | NIL | NIL | NIL | NIL | NIL | NIL | NIL |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301281A.CEO.1: To realise the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.
2301281A.CEO.2: To identify the importance of fundamental rights as well as fundamental duties.
2301281A.CEO.3: To understand the functioning of Union, State and Local Governments in Indian federal system
2301281A.CEO.4: To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301281A.CO.1: Explain the significance of Indian Constitution as the fundamental law of the land [L2].
2301281A.CO.2: Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building [L2].
2301281A.CO.3: Analyze the Indian political system, the powers and functions of the Union, State and Local Governments in detail [L3].
2301281A.CO.4: Explain Electoral Process, Emergency provisions and Amendment procedure [L2].

## COURSE ABSTRACT

Indian constitution is an audit course designed for the all FY. BTech students. Indian constitution is a great source of human values promoting through its legislative, executive and judiciary institutions. The key values that are learnt from constitution are justice, liberty, equality and fraternity. Constitution also teaches us to be impartial, non-partisan and tolerant in our attitude and public interactions. Liberty of thought, expression, belief or faith is necessary for all round development of an individual which the constitution teach and protects. It also inculcates the value of fraternity that promotes the spirit of common brotherhood among all citizens.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Indian Constitution** | **3 HOURS** |

Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India, Salient features and characteristics of the Constitution of India, Scheme of the fundamental rights, The scheme of the Fundamental Duties and its legal status, The Directive Principles of State Policy – Its importance and implementation.

| | | |
|---|---|---|
| **UNIT 2** | **Federal Structure and Amendment** | **5 HOURS** |

Federal structure and distribution of legislative and financial powers, between the Union and the States, Parliamentary Form of Government in India – The constitution powers and status of the President of India, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India.

| | | |
|---|---|---|
| **UNIT 3** | **Emergency Provisions** | **2 HOURS** |

Emergency Provisions: National Emergency, President Rule, Financial Emergency.

| | | |
|---|---|---|
| **UNIT 4** | **Constitutional Schemes** | **5 HOURS** |

Local Self Government – Constitutional Scheme in India, 13. Scheme of the Fundamental Right to Equality, Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and Personal Liberty under Article 21.

## TEXT BOOKS


1. Basu, D. D., Manohar, V. R., Banerjee, B. P., & Khan, S. A. (2015). Introduction to the Constitution of India (pp. 87-9). Gurgaon: LexisNexis..
2. Austin, G. (1966). The Constitution of India: Cornerstone of a Nation.


## REFERENCE BOOKS


1. Bakshi, P. M., & Kashyap, S. C. (1982). The constitution of India. Universal Law Publishing.
2. Pylee, M. V. (2003). Constitutional government in India. S. Chand Publishing.


## E-RESOURCES (NPTEL Courses)

1. Constitutional Studies - Course (nptel.ac.in)

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## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# Third Year

# Bachelor of Technology

# E&TC Engineering

## NEP REVISION 2023 (2.0)

(With Effect from Academic Year: 2028-2029)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2028-2029 |
| THIRD YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

**SEMESTER: V**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2307311T | Computational Intelligence | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307311L | Computational Intelligence Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2307312T | Control Systems | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307312L | Control Systems Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PEC | 2307321T | Embedded Systems for IoT | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307321L | Embedded Systems for IoT Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2307322T | EV architecture and Dynamics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307322L | EV architecture and Dynamics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2307323T | Configurable Logic Design | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307323L | Configurable Logic Design Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| VSEC | 230736XL | Skill Courses | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| MDM | *MDM List | MDM Course-II | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | *MDM List | MDM Course-II Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ELC PRJ | 2307391L | Major Project - I | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2307396L | Internship (Technical) | - | - | - | - | - | - | - | 75 | 75 | 2 |
| **TOTAL** | | | **11** | **16** | **-** | | | | | | **800** | **21** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2028-2029 |
| THIRD YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

**SEMESTER: VI**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2307313T | Embedded Edge AI | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307313L | Embedded Edge AI Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2307314T | Digital Signal & Image Processing | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307314L | Digital Signal & Image Processing Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PEC | 2307324T | Introduction to Security of Cyber Physical Systems | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307324L | Introduction to Security of Cyber Physical Systems Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2307325T | Power Electronics in Electric Mobility | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307325L | Power Electronics in Electric Mobility Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2307326T | CMOS VLSI Design | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2307326L | CMOS VLSI Design Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| VSEC | 230736XL | Skill Courses | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| MDM | *MDM List | MDM Course-III | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | *MDM List | MDM Course-III Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| HSSM AEC | 2301371L | Employability and Career Development | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC PRJ | 2307392L | Major Project - II | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| **TOTAL** | | | **11** | **20** | **-** | | | | | | **800** | **21** |

*Four Credit Internship needs to be completed after Completion of the Third Yea

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Computational Intelligence |
| | **COURSE CODE** | 2307311T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2307311T.CEO.1: To familiarize with the basic concepts and techniques of computational intelligence.
2307311T.CEO.2: To interpret a data analytic process and performance measures.
2307311T.CEO.3: To explain the mathematical foundation for machine learning algorithms.
2307311T.CEO.4: To give exposure to unsupervised machine learning algorithms for solving practical problems.
2307311T.CEO.5: To introduce foundation machine learning operations (MLOps) for handling computational intelligent systems.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307311T.CO.1: Describe the fundamentals of machine learning [L2].
2307311T.CO.2: Apply data analytics to improve the performance of intelligent systems [L3].
2307311T.CO.3: Analyze mathematically various supervised and unsupervised machine learning models [L3].
2307311T.CO.4: Evaluate the performance of the machine learning model for appropriate intelligent model selection [L4].
2307311T.CO.5: Develop the intelligent solution for a real-life problem using Machine Learning Operations (MLOps)[L5].

**COURSE ABSTRACT:**

This course introduces students to the exciting field of computational intelligence, focusing specifically on the application of machine learning algorithms. Computational intelligence encompasses a range of techniques inspired by machine learning algorithms, to solve complex real-world problems. Machine learning, a subset of computational intelligence, has seen remarkable advancements and is now global in various domains, including finance, healthcare, agricultural, robotics, and more. Topics include exploratory data analysis, supervised learning methods as well as unsupervised learning techniques like clustering and dimensionality reduction. Case studies highlighting successful implementations and challenges faced in real-world scenarios. This course would provide students with a comprehensive understanding of both computational intelligence and machine learning techniques, equipping them with the knowledge and skills to tackle complex real-world problems effectively.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Machine Learning Fundamentals** | **08 HOURS** |

**Applications/Case Study:** Applications for machine learning in semiconductor, use cases for electric vehicles

**Contents:** Introduction to computational intelligence, describe machine learning techniques: supervised learning, unsupervised learning and reinforcement learning, linear regression, logistic regression, applications of machine learning.

**Further Readings/Self Study:** Real-life examples of intelligence systems based on regression and classification

| | | |
|---|---|---|
| **UNIT 2** | **Intelligent Analytics Process** | **06 HOURS** |

**Applications/Case Study:** Banking and marketing application, communication system

**Contents:** Understanding data, exploratory data analysis (EDA), feature encoding, feature scaling, feature importance, outlier analysis, concept of under-fitting, over-fitting, bias-variance trade-off, model assessment, cross validations, accuracy and error measures, confusion metric, precision, recall, F1 Score, analysis of ROC, AUC, performance matrices, model selection & evaluation, optimization of tuning parameters .

**Further Readings/Self Study:** Grid Search CV

| | | |
|---|---|---|
| **UNIT 3** | **Ensemble Learning** | **08 HOURS** |

**Applications/Case Study:** Intelligent healthcare care management system using ensembles models

**Contents:** Representing concepts such as Decision Trees, best splitting attributes: entropy and information gain, regression tree, searching for simple trees and computational complexity, over-fitting, and pruning, random forest, ensembles methods - stacking, voting, bagging, boosting- AdaBoost.

**Further Readings/Self Study:** XGBoost

| | | |
|---|---|---|
| **UNIT 4** | **Supervised Machine Learning** | **08 HOURS** |

**Applications/Case Study:** Smart agriculture using machine learning, image classification

**Contents:** Bays theorem, Nave Bayes, K Nearest Neighbors (KNN.), Support Vector Machine, Maximum Margin Principle Optimization Objective of SVM, control Variable of SVM, types of Multi-Class SVM, Kernel Function

**Further Readings/Self Study:** KNN distance matrices, SVM regression

| UNIT 5 | Unsupervised Learning | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Customer data, social network ads.

**Contents:** Feature space, dimensional reduction, eigen values, eigen vector, principal components analysis (PCA), introduction to clustering, types of clustering: partitional clustering - K-means clustering, hierarchical agglomerative clustering.

**Further Readings/Self Study:** Divisive clustering

| UNIT 6 | Foundation Machine Learning Operations (MLOps) | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Deployment of ML Model on real-life project

**Contents:** MLOps fundamentals, deployment of ML model, Git basics, basic of machine learning data lifecycle in production, steps of machine learning modeling pipelines in production

**Further Readings/Self Study:** Docker

## TEXT BOOKS


1. Alpaydin Ethem. (2015). *Introduction to Machine Learning*. 3rd Edition, PHI Learning Pvt. Ltd. ISBN 978-8120350786.
2. N. Meenakshi, K. E. Rajkumari, S. HariharaSitharaman . (2021). *Data Science and Machine Learning*. 1st Edition, Notion Press. ISBN 978-1638069911.


## REFERENCE BOOKS


1. Kevin P. Murphy (2012). *Machine Learning: A Probabilistic Perspective*. 1st Edition, MIT Press. ISBN 978-0262018029.
2. Marc Peter Deisenroth , A. Aldo Faisal . (2002). *Mathematics for Machine Learning*. 1st Edition, Cambridge University Press. ISBN 978-1108455145.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2028 - 2029 (Rev. 2023 (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Computational Intelligence Lab |
| | COURSE CODE | 2307311L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307311L.CEO.1: To explain exploratory data analysis concepts to real-world datasets for computational intelligence applications.

2307311L.CEO.2: To provide a hands-on implementation of a machine learning framework using different datasets.

2307311L.CEO.3: To assess model performance and select optimal models for specific applications through experimentation.

2307311L.CEO.4: To deploy machine learning models and demonstrate proficiency in handling practical projects for computational intelligence applications using MLOps principles.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307311L.CO.1: Apply different exploratory data analysis techniques to prepare datasets for analysis [L3].

2307311L.CO.2: Build machine learning algorithms for real-life problems in electronics engineering or interdisciplinary fields using modern tools [L3].

2307311L.CO.3: Examine the performance of the machine learning model for appropriate model selection [L4].

2307311L.CO.4: Deploy intelligent machine learning models using MLOps principles for solving practical problems [L4].

**COURSE ABSTRACT:**

A computational intelligence lab using machine learning typically involves a series of experiments, projects, and assignments that focus on applying machine learning algorithms to solve real-world problems. Understanding various datasets from different domains (e.g., image, text, audio, video, sensor data) by dataset preprocessing, and feature engineering. Implementing machine learning solutions for real-world problems in domains like healthcare, finance, agriculture, and more. Implementation of machine learning and computational intelligence algorithms using programming languages like Python. Deploying machine learning (ML) models involves making trained models available for use in real-world scenarios, often in production environments. By setting up a computational intelligence lab with these components and activities, students can engage in cutting-edge machine learning research and applications, contributing to advancements in the field and solving practical problems.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Exploratory Data Analysis (EDA)** | **4 HOURS** |
| Implement data prepossessing and visualization,feature encoding and scaling | | |
| **PRACTICAL NO.02** | **Liner Regression and Logistic Regression** | **4 HOURS** |
| To predict battery life using a linear regression model<br>Developed a logistic regression model for classification of Insurance dataset. | | |
| **PRACTICAL NO.03** | **Decision Tree, Random Forest and Ensemble Model** | **4 HOURS** |
| Implement intelligent health care management system. | | |
| **PRACTICAL NO.04** | **Machine Learning- Supervised KNN** | **2 HOURS** |
| Application and development of smart agriculture. | | |
| **PRACTICAL NO.05** | **Machine Learning- Supervised SVM** | **2 HOURS** |
| Implementation image classification using SVM. | | |
| **PRACTICAL NO.06** | **Machine Learning- Supervised Nave Bayes** | **2 HOURS** |
| Implementation text data analysis for spam mail prediction | | |
| **PRACTICAL NO.07** | **Machine Learning- Unsupervised Clustering** | **2 HOURS** |
| Implementation of unsupervised machine learning algorithm-K means clustering for customer segmentation | | |
| **PRACTICAL NO.08** | **Deployment of Machine Learning Model** | **4 HOURS** |
| Implement machine learning model deployment using Streamlit and Flask application | | |
| **PRACTICAL NO.09** | **Laboratory Project and Demonstration** | **2 HOURS** |
| Demonstration of Laboratory project implementing ML algorithms .<br>Presentation of implementation of results for assigned project problem statement | | |

## TEXT BOOKS


1. Aurelien Geron (2022). *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems*. 3rd Edition, O'Reilly Media, Inc. Publishers. ISBN 978-1098125974.
2. Wes McKinney . (2022). *Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter*. 3rd Edition, O'Reilly Media. ISBN 978-1098104030.


## REFERENCE BOOKS


1. Andreas Mller, Sarah Guido. (2016). *Introduction to Machine Learning with Python: A Guide for Data Scientists*. 1st Edition, O'Reilly Media. ISBN 978-1449369415.
2. Chip Huyen. (2022). *Designing Machine Learning Systems: An Iterative Process for Production-Ready Applications*. 1st Edition, O'Reilly Media. ISBN 978-1098107963.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Control Systems |
| | **COURSE CODE** | 2307312T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307312T.CEO.1: To provide understanding of fundamental control theory concepts, including system dynamics, stability criteria, and controller design techniques.

2307312T.CEO.2: To equip students with the skills to analyze system behavior using time-domain and frequency-domain techniques.

2307312T.CEO.3: To provide knowledge and methodologies for designing and implementing various control strategies, including PID controllers, root locus, and frequency response methods.

2307312T.CEO.4: To introduce the principles and applications of digital control systems, including discrete-time systems and z-transform.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307312T.CO.1: Apply knowledge of mathematics, science, and engineering fundamentals to derive mathematical models of dynamic systems [L3].

2307312T.CO.2: Analyze system behavior using time domain and frequency domain techniques [L4].

2307312T.CO.3: Evaluate the stability of control systems using various criteria and methods [L5].

2307312T.CO.4: Design and implement controllers continuous time (PID, state feedback, etc.) and digital control systems to meet desired system specifications [L6].

**COURSE ABSTRACT:**

Control Systems is the study of the analysis and regulation of the output behaviors of dynamical systems subject to input signals. The concepts and tools discussed in this course can be used in a wide spectrum of engineering disciplines such as mechanical, electrical, aerospace, manufacturing, and biomedical engineering. The emphasis of this course will be on the basic theories and feedback controller design methods of linear time-invariant systems.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Mathematical Modelling of physical systems** | **10 HOURS** |

**Case Study:** Antenna Azimuth: An Introduction to Position Control Systems

**Contents:** Concepts of Control Systems - Open Loop and closed loop control systems, Transfer function representation, Block diagram reduction techniques - Signal flow graph - Mason's Rule, State Space representation - Relation between Laplace Transform and State Space Representation, Linearization of nonlinear systems.

**Further Readings:** MATLAB Automotive Advisory Board (MAAB) Guidelines

| | | |
|---|---|---|
| **UNIT 2** | **Time domain analysis** | **08 HOURS** |

**Case Study:** Unmanned Free-Swimming Submersible Vehicle: Open-Loop Pitch Response

**Contents:** Standard test signals, Time response of first order systems, Characteristic Equation of Feedback control systems, Transient response of second order systems, Time domain specifications, Steady state response, Steady state errors and error constants.

**Further Readings:** H. H. Rosenbrock, "Time-Domain Analysis and Design of Control Systems," in Electronics and Power, vol. 12, no. 4, pp. 135-, April 1966, doi: 10.1049/ep.1966.0107.

| | | |
|---|---|---|
| **UNIT 3** | **Stability Analysis** | **10 HOURS** |

**Case Study:** Antenna Control: Stability Design and Transient Performance

**Contents:** Concept of stability, necessary and sufficient conditions for stability, BIBO stability, Routh-Hurwitz criterion, Root locus plots, relative stability, Frequency domain specifications, Bode plots.

**Self Study:** Nyquist plot, Nyquist stability criterion

| | | |
|---|---|---|
| **UNIT 4** | **Controller Design** | **08 HOURS** |

**Contents:** Design of P, PI, PID, lag, lead, lead-lag compensator design, Controller design in state space using pole placement, controllability, observability

**Further Readings/Self Study:** Katsuhiko Ogata, "PID Controllers and Modified PID Controllers", *Modern Control Engineering*, 5th ed., Pearson, 2009.

| | | |
|---|---|---|
| **UNIT 5** | **Introduction to Digital Control** | **06 HOURS** |

**Case Study:** Antenna Control: Digital Cascade Compensator Design

**Contents:** Comparison between analog and digital control, Importance of digital control, Structure of digital control, Examples of digital control system, Difference equations, Z-transform, MATLAB examples

**Further Readings/Self Study:** Norman S. Nise, "Digital Control Systems", *Control Systems Engineering*, 7th ed., Wiley, 2018.

## TEXT BOOKS


1. I.J. Nagarath and M. Gopal. (2018). *Control Systems Engineering*. 6$^{th}$ Edition, New Age Pub.Co. ISBN 978-8195175581.
2. Norman S. Nise. (2018). *Control Systems Engineering*. 7$^{th}$ Edition, Wiley. ISBN 978-8126571833.


## REFERENCE BOOKS


1. K. Ogata. (2015). *Modern Control Engineering*. 5$^{th}$ Edition, Prentice Hall. ISBN 978-9332550162.
2. Richard C. Dorf and Robert H. Bishop. (2021). *Modern Control Systems*. 14$^{th}$ Edition, Pearson Education Limited. ISBN 978-1292422374 .
3. B.C. Kuo. (2014). *Automatic Control Systems*. 9$^{th}$ Edition, Wiley. ISBN 978-8126552337.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Control Systems Lab |
| | **COURSE CODE** | 2307312L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307312L.CEO.1: To reinforce theoretical concepts learned in the control systems lecture through hands-on experiments and applications.

2307312L.CEO.2: To provide experience with software tools for simulation, control design, and data analysis.

2307312L.CEO.3: To cultivate the ability to analyze experimental data, interpret results, and compare them with theoretical predictions.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307312L.CO.1: Make use of software tools effectively for simulating, designing, and analyzing control systems [L3].

2307312L.CO.2: Analyze and interpret experimental data, draw valid conclusions, and compare experimental results with theoretical expectations [L4].

2307312L.CO.3: Design, implement, and test control algorithms on physical systems and hardware [L6].

## COURSE ABSTRACT:

The Control Systems Laboratory course offers hands-on experience in the design, analysis, and implementation of control systems. Students apply theoretical concepts through experiments involving system modeling, PID control, state-space analysis, and digital control. Utilizing simulation tools and real-time platforms, they gain proficiency in control systems design. The course emphasizes practical problem-solving, teamwork, and technical communication, bridging the gap between theory and real-world applications. By completing this course, students develop the skills needed to design, optimize, and implement effective control systems in various engineering fields.

## PRACTICALS

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Simulation of Physical systems** | **6 HOURS** |
| Developing mathematical model of physical systems using simulation software. | | |
| **PRACTICAL NO.02** | **Time Domain analysis** | **4 HOURS** |
| Perform time domain analysis for a given physical system. | | |
| **PRACTICAL NO.03** | **Stability analysis** | **6 HOURS** |
| Carry out stability analysis (time and frequency domain) for a given physical system. | | |
| **PRACTICAL NO.04** | **Controller design** | **6 HOURS** |
| Design of an appropriate control algorithm for the given system. | | |
| **PRACTICAL NO.05** | **Model based Design** | **6 HOURS** |
| Perform Model-in-the-Loop (MIL), Software-in-the-Loop (SIL) and Processor-in-the-Loop (PIL) Simulation for the given system. | | |

## TEXT BOOKS

1. I.J. Nagarath and M. Gopal. (2018). *Control Systems Engineering*. 6$^{th}$ Edition, New Age Pub.Co. ISBN 978-8195175581.
2. Norman S. Nise. (2018). *Control Systems Engineering*. 7$^{th}$ Edition, Wiley. ISBN 978-8126571833.

## REFERENCE BOOKS

1. K. Ogata. (2015). *Modern Control Engineering*. 5$^{th}$ Edition, Prentice Hall. ISBN 978-9332550162.
2. Richard C. Dorf and Robert H. Bishop. (2021). *Modern Control Systems*. 14$^{th}$ Edition, Pearson Education Limited. ISBN 978-1292422374 .
3. B.C. Kuo. (2014). *Automatic Control Systems*. 9$^{th}$ Edition, Wiley. ISBN 978-8126552337.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Embedded Systems for IoT |
| | **COURSE CODE** | 2307321T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2307321T.CEO.1: To illustrate the foundational elements of embedded systems for IoT applications.
2307321T.CEO.2: To provide the comprehensive overview of IoT architecture models and specifications.
2307321T.CEO.3: To impart knowledge of IoT networking architectures and standards.
2307321T.CEO.4: To familiarize with the cloud platforms for IoT applications.
2307321T.CEO.5: To provide a platform where student can work on real-world IoT applications.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307321T.CO.1: Illustrate the evolution and trends in embedded systems for IoT [L3].
2307321T.CO.2: Interpret the functional blocks of IoT architecture and models [L3].
2307321T.CO.3: Configure IoT systems using IoT standards and protocols [L4].
2307321T.CO.4: Consider cloud interfaces for real-world IoT applications [L5].
2307321T.CO.5: Design simple real-world IoT applications [L6].

**COURSE ABSTRACT:**

The course offers a comprehensive introduction to the Internet of Things, covering essential topics such as IoT architecture, standards, and protocols. Participants will explore how sensors, devices, and connectivity form robust IoT systems and learn about key communication protocols like MQTT and CoAP. The course delves into the pivotal role of cloud computing in IoT for data management and scalability. Additionally, real-world use cases across industries such as smart homes, healthcare, and agriculture will be discussed, illustrating IoT's transformative impact. This course equips beginners with the foundational knowledge needed to understand and engage with IoT technologies.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **IoT Infrastructure: Embedded Systems Essentials** | **08 HOURS** |

**Applications/Case Study:** Real-world examples of embedded systems for IoT applications.

**Contents:** Embedded system components, Evolution and trends in embedded systems for IoT, Embedded systems architecture, Components for physical modelling: microcontrollers, memories, input/output devices, communication interfaces and power management Components for logical modelling: Programming interfaces (IDEs), Basic features and functionalities of ESP8266, ESP32, Raspberry-Pi boards.

**Further Readings/Self Study:** Survey of popular Embedded System Development Boards with IoT capabilities

| | | |
|---|---|---|
| **UNIT 2** | **IoT System Architecture** | **08 HOURS** |

**Applications/Case Study:** Project demonstrations using IoT application development boards.

**Contents:** Overview of IoT components, Role of Embedded System in IoT, Physical and Logical Model of IoT, IoT Reference Model, IoT Enabling Technologies, Communication Models, IoT design principles and needed capabilities, IoT Level Specifications.

**Further Readings/Self Study:** Identify and analyze different IoT applications based on IoT level specifications.

| | | |
|---|---|---|
| **UNIT 3** | **IoT Standards and Protocols** | **08 HOURS** |

**Applications/Case Study:** Multi-Node Cross Communication using ESP8266 Mesh Network.

**Contents:** IoT Standards: NFC, RFID, IEEE 802.11 (Wi-Fi); IoT Devices Application-Level Protocols: MQTT, CoAP, HTTP, APIs: REST, Web-Socket.

**Further Readings/Self Study:** Performance comparison of different standards and networking protocols.

| | | |
|---|---|---|
| **UNIT 4** | **IoT Frameworks: Cloud Platforms for IoT** | **08 HOURS** |

**Applications/Case Study:** Remote Monitoring and Control Application for Smart Home using Cloud Platform.

**Contents:** Cloud Computing fundamentals, Cloud Types and Services, Cloud Architecture, Open-Source Cloud Platforms for IoT.

**Further Readings/Self Study:** Management and Security in Cloud Computing.

| UNIT 5 | IoT Applications and Use-Cases | 08 HOURS |
|---|---|---|

**Applications/Case Study:** IoT Solutions for Smart Home Energy Management.

**Contents:** IoT use-cases: Precision Farming, Industrial Automation, Smart Car Parking, Air-Pollution with purpose and requirement specifications, IoT level specifications and operational view specifications.

**Further Readings/Self Study:** Exploration of some potential applications of IoT to provide sustainable solutions.

## TEXT BOOKS


1. Bahga, A., Madisetti, V. (2015). *Internet of Things: A Hands-on Approach*. 1st Edition, University Press. ISBN 978-81-7371-954-7.
2. Hanes, D., Salgueiro, G. (2017). *IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things*. 1st Edition, Cisco Press. ISBN 978-1-58714-456-3.
3. Javed, A. (2016). *Building Arduino Projects for the Internet of Things*. 1st Edition, Apress. ISBN 978-1-4842-1947-8.


## REFERENCE BOOKS


1. Ashton, K. (2015). *How to Fly a Horse: The Secret History of Creation, Invention, and Discovery*. 1st Edition, Anchor Books. ISBN 978-0-307-47410-9.
2. Miller, M. (2015). *The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World*. 1st Edition, Que Publishing. ISBN 978-0-7897-5389-6.
3. McEwen, A., Cassimally, H. (2013). *Designing the Internet of Things*. 1st Edition, Wiley. ISBN 978-1-118-36130-6.
4. Areny, R., Webster, J. (2012). *Sensors and Signal Conditioning*. 2nd Edition, Wiley. ISBN 9780470054574.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2028 - 2029 (Rev. 2023 (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Embedded Systems for IoT Lab |
| | COURSE CODE | 2307321L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307321L.CEO.1: To equip students with the skills to design and implement IoT systems using sensors, microcontrollers, and communication modules.

2307321L.CEO.2: To provide hands-on experience with IoT communication protocols and data exchange techniques.

2307321L.CEO.3: To enable students to utilize cloud services for data management, processing, and analytics in IoT projects.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307321L.CO.1: Create and deploy functional IoT prototypes [L6].

2307321L.CO.2: Demonstrate proficiency in implementing and troubleshooting IoT communication protocols [L3].

2307321L.CO.3: Effectively integrate cloud services to enhance IoT project functionality and scalability [L4].

**COURSE ABSTRACT:**

The course offers a comprehensive introduction to the Internet of Things, covering essential topics such as IoT architecture, standards, and protocols. Participants will explore how sensors, devices, and connectivity form robust IoT systems and learn about key communication protocols like MQTT and CoAP. The course delves into the pivotal role of cloud computing in IoT for data management and scalability. Additionally, real-world use cases across industries such as smart homes, healthcare, and agriculture will be discussed, illustrating IoT's transformative impact. This course equips beginners with the foundational knowledge needed to understand and engage with IoT technologies.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Basic IoT Applications using CISCO Packet Tracer** | **2 HOURS** |
| To implement an alarm system using motion sensor and actuators in CISCO Packet Tracer. | | |
| **PRACTICAL NO.02** | **Basic IoT Applications using CISCO Packet Tracer** | **2 HOURS** |
| To build a home automation system using home gateway in CISCO Packet Tracer. | | |
| **PRACTICAL NO.03** | **Basic IoT Applications using CISCO Packet Tracer** | **2 HOURS** |
| To implement smart irrigation system using multiple sensors and actuators in CISCO Packet Tracer. | | |
| **PRACTICAL NO.04** | **Basic Networking with ESP8266 WiFi module** | **2 HOURS** |
| To create Blynk Dashboard for two end-devices and configure it to control switching of an LED remotely | | |
| **PRACTICAL NO.05** | **Basic Networking with ESP8266 WiFi module** | **2 HOURS** |
| To implement a real-time monitoring system for measuring environmental parameters using ThingSpeak platform. | | |
| **PRACTICAL NO.06** | **Basic Networking with ESP8266 WiFi module** | **2 HOURS** |
| To build remote monitoring and control system for electrical appliances using a web-server application. | | |
| **PRACTICAL NO.07** | **Configuring Communication/ Networking Interfaces** | **2 HOURS** |
| To establish multi-device communication using ESP8266 mesh networking. | | |
| **PRACTICAL NO.08** | **Configuring Communication/ Networking Interfaces** | **2 HOURS** |
| To demonstrate the use of MQTT for publishing and subscribing to messages between an IoT device (Raspberry Pi) and a cloud-based MQTT broker. | | |
| **PRACTICAL NO.09** | **Configuring Communication/ Networking Interfaces** | **2 HOURS** |
| To build a Voice-Activated Personal Assistant(VPA) application using NodeMCU and the Google Assistant API. | | |

## TEXT BOOKS


1. Bahga, A., Madisetti, V. (2015). *Internet of Things: A Hands-on Approach*. 1st Edition, University Press. ISBN 978-81-7371-954-7.
2. Hanes, D., Salgueiro, G. (2017). *IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things*. 1st Edition, Cisco Press. ISBN 978-1-58714-456-3.
3. Javed, A. (2016). *Building Arduino Projects for the Internet of Things*. 1st Edition, Apress. ISBN 978-1-4842-1947-8.


## REFERENCE BOOKS


1. Ashton, K. (2015). *How to Fly a Horse: The Secret History of Creation, Invention, and Discovery*. 1st Edition, Anchor Books. ISBN 978-0-307-47410-9.
2. Miller, M. (2015). *The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World*. 1st Edition, Que Publishing. ISBN 978-0-7897-5389-6.
3. McEwen, A., Cassimally, H. (2013). *Designing the Internet of Things*. 1st Edition, Wiley. ISBN 978-1-118-36130-6.
4. Areny, R., Webster, J. (2012). *Sensors and Signal Conditioning*. 2nd Edition, Wiley. ISBN 9780470054574.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2028 - 2029 (Rev. 2023 (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | EV Architecture and Dynamics |
| | COURSE CODE | 2307322T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307322T.CEO.1: To explore the emerging trends and future developments in Electric vehicle technology

2307322T.CEO.2: To familiarize students with fundamentals of Electric vehicle.

2307322T.CEO.3: To demonstrate Electric vehicle architecture.

2307322T.CEO.4: To expose Vehicle Modelling and simulation based on its Dynamics .

2307322T.CEO.5: To explore the Electric vehicle transmission system

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307322T.CO.1: Identify the current scenario of different types of electric vehicle with efficiency analysis [L2].

2307322T.CO.2: Illustrate the Electric vehicle architecture and its integrated components [L4].

2307322T.CO.3: Analyze Vehicle performance parameters [L4].

2307322T.CO.4: Demonstrate different types of Electric vehicle transmission system and its design consideration [L3]

**COURSE ABSTRACT:**

The course is a beginner-level course designed to introduce students to Electric vehicles and give them a brief idea about electric vehicles, and its importance. This course gives some basic technical foundations regarding electric vehicles In-order to help them move on to advanced level.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Electric Vehicle Scenario, Current and future** | **08 HOURS** |

**Case Study:** Electric Vehicle current market scenario

**Contents:** : Electric Vehicles History,Technology scenario, Market scenario, social and environmental importance of electric vehicles, impact of modern drivetrain on energy supplies. Policies regulation, Indian policies, Challenges,National Electric Mobility Mission Plan, FAME 1 and 2 India Scheme,PLI Schemes, AIS Standards for EV.

**Further Readings/Self Study:** :Report on Electric Mobility in India 2020,EV Market Outlook for India 2021-2030

| | | |
|---|---|---|
| **UNIT 2** | **Overview of Electric Vehicles** | **08 HOURS** |

**Case Study:** Comparison of ICE with BEV on different Model

**Contents:**Basics of Electric Vehicles,Components of Electric Vehicle,General Layout of EV,EV Classification: Battery Electric Vehicles (BEVs), Fuel-Cell Electric Vehicles(FCEVs),Extend range electric vehicles,plug-in hybrid electric vehicles (PHEVs),Comparison with Internal Combustion Engine,the suspension, steering, brakes, and shifting mechanisms, Advantages, Disadvantages of EVs,Well-to-Wheel Efficiency,Tank-to-Wheel Efficiency,Energy flow analysis for EV ICEVs

**Further Readings/Self Study:** Westbrook, M.H. (2001) The Electric Car, The Institution of Electrical Engineers, London

| | | |
|---|---|---|
| **UNIT 3** | **EV Architecture** | **08 HOURS** |

**Case Study:** Case study of any EV architecture

**Contents:** TElectric Vehicle Architecture, Powertrain: Electric motor, Battery pack, Inverter, Charger, converter, Regenerative braking

**Further Readings/Self Study:** Voltage levels,2W/3W/4Wheeler/LCV architecture - James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2012. .

| | | |
|---|---|---|
| **UNIT 4** | **Vehicle Dynamics** | **08 HOURS** |

**Case Study:** Indian Drive Cycle for a 2Wheeler/3Wheeler/4Wheeler

**Contents:** Roadway Fundamentals, Laws of Motion,Tractive Effort,- Rolling Resistance Force, Aerodynamic Drag, Hill Climbing Force, Acceleration Force, Dynamic Equation , Calculation of acceleration force,Tractive effort, Torque required on the wheel, Torque speed characteristics of electric vehicle,Modelling Vehicle Acceleration- Acceleration Performance Parameters, Driving Cycles

**Self Study:** Comparative Analysis of Indian Drive Cycle with Different Countries.

| | | |
|---|---|---|
| **UNIT 5** | **EV Transmission System** | **08 HOURS** |

**Contents:** Transmission system: Need, Torque Speed Characteristics of IC Engine and Motor, Comparison with ICEV Transmission system,Types of EV transmission,Selection of transmission system, Estimation of gear ratio and its design consideration

## TEXT BOOKS


1. Iqbal Hussein.(2021) *Electric and Hybrid Vehicles: Design Fundamentals*. 3rd Edition, CRC Press,ISBN 978-0849312249.
2. James Larminie, John Lowry, S.(2012).*Electric Vehicle Technology Explained,*. 2nd Edition, Pearson Education,Wiley publication, ISBN 9780470851638.


## REFERENCE BOOKS


1. Chris Mi, M. Abul Masrur, David Wen zhong Gao.(2011) *Hybrid Electric Vehicles Principles and Appli cations with Practical Perspectives*. 7th Edition,Wiley publication, ISBN 978-0470180969.
2. Leitman,Seth.,Brant,Bob.(2013) *Build Your Own Electric Vehicle.*.3rd Edition,McGraw-Hill Education.ISBN 978-0071770569.
3. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi(2004), Modern Electric, *Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design*. 3rd Edition,CRC Press,.ISBN 978-0849310795.
4. Thomas D. Gillespie (2021) *Fundamental of vehicle dynamics,*..2nd Edition,SAE internatioonal.ISBN 978-0071770569.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | EV Architecture and Dynamics Lab |
| | **COURSE CODE** | 2307322L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.1 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307322L.CEO.1: To introduce students to the fundamentals of electric vehicle
2307322L.CEO.2: To showcase the architecture of electric vehicles
2307322L.CEO.3: To introduce vehicle modeling and simulation based on its dynamics.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307322L.CO.1: Demonstrate the different components of Electric vehicle [L2].
2307322L.CO.2: Evaluate the performance parameters of the Electric vehicle.[L4]
2307322L.CO.3: Elaborate different case studies on recent research in the field of Electric vehicle [L5]

**COURSE ABSTRACT:**

The course is a beginner-level course designed to introduce students to Electric vehicles and give them a brief idea about electric vehicles, and its importance. This course gives some basic technical foundations regarding electric vehicles In-order to help them move on to advanced level.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Components of EV** | **2 HOURS** |
| Study of various components of electric vehicle. | | |
| **PRACTICAL NO.02** | **Demonstration of E-bike** | **4 HOURS** |
| Demonstration, Dismantling Assembling of electric scooter. | | |
| **PRACTICAL NO.03** | **Performance characteristics of electric Scooter** | **4 HOURS** |
| Measure and analyze the performance characteristics of the electric scooters battery pack, including capacity, voltage, current, and temperature under different operating conditions. | | |
| **PRACTICAL NO.04** | **Motor Controller Parameters and Configuration** | **4 HOURS** |
| Evaluate the performance of the electric scooters motor by mapping and configuration of motor and controller parameter | | |
| **PRACTICAL NO.05** | **Effect of Rolling resistance, Aerodynamic drag and hill climbing force on Vehicle range** | **4 HOURS** |
| Develop a simulation model to evaluate the effect of Rolling Resistance, Aerodynamic drag, and hill climbing force on vehicle range and Performance | | |
| **PRACTICAL NO.06** | **DBC file Config. and BUS MASTER handling** | **4 HOURS** |
| To create a DBC file from the CAN matrix and associate it with the BUSMASTER software. | | |
| **PRACTICAL NO.07** | **Introduction to CAN Communication** | **2 HOURS** |
| To log the CAN data into a .txt file plot the signal and observe the trends | | |
| **PRACTICAL NO.08** | **Case study** | **4 HOURS** |

- Case study on recent research in the field of EV Technology
- Case study on challenges future scope of electric vehicle

**TEXT BOOKS**


1. Iqbal Hussein.(2021) *Electric and Hybrid Vehicles: Design Fundamentals*. 3rd Edition, CRC Press,ISBN 978-0849312249.
2. James Larminie, John Lowry, S.(2012).*Electric Vehicle Technology Explained,*. 2nd Edition, Pearson Education,Wiley publication, ISBN 9780470851638.

## REFERENCE BOOKS


1. Chris Mi, M. Abul Masrur, David Wen zhong Gao.(2011) *Hybrid Electric Vehicles Principles and Appli cations with Practical Perspectives*. 7th Edition,Wiley publication, ISBN 978-0470180969.
2. Leitman,Seth.,Brant,Bob.(2013) *Build Your Own Electric Vehicle.*.3rd Edition,McGraw-Hill Education.ISBN 978-0071770569.
3. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi(2004), Modern Electric, *Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design*. 3rd Edition,CRC Press,.ISBN 978-0849310795.
4. Thomas D. Gillespie (2021) *Fundamental of vehicle dynamics,*..2nd Edition,SAE internatioonal.ISBN 978-0071770569.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2028 - 2029 (Rev. 2023 (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Configurable Logic Design |
| | COURSE CODE | 2307323T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :**

**COURSE OBJECTIVES :**

2307323T.CEO.1: To impart the knowledge of reconfigurable architectures for design optimization .
2307323T.CEO.2: To reinforce the utilization of different Verilog coding styles .
2307323T.CEO.3: To facilitate the students for verification of Digital Circuits.
2307323T.CEO.4: To introduce the application of System on Chip platforms for basic building blocks.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307323T.CO.1: Identify reconfigurable architectures for different applications [L3].
2307323T.CO.2: Develop Verilog code in different modeling styles for given digital circuits [L3].
2307323T.CO.3: Analyze the behavior of the Verilog code with system verification methodology [L4].
2307323T.CO.4: Design a System on Chip application for basic building blocks [L3].
2307323T.CO.5: Construct the Verilog code with known synthesis methods for design optimization [L4] .

**COURSE ABSTRACT:**

This course provides an introduction to the reconfigurable logic design, focusing on the use of Field-Programmable Gate Arrays (FPGAs) and Complex Programmable Logic Devices (CPLDs). Students will gain a comprehensive understanding of the VLSI design flow, Verilog as a hardware description language and advanced verification techniques using SystemVerilog. The course covers both theoretical concepts and practical demonstration which enables the students to design, implement, and verify complex digital systems. Key topics include combinational and sequential logic design, digital design synthesis and optimization, and System-on-Chip (SoC) design. Through hands-on lab sessions and case studies, students will develop the skills necessary to tackle real-world engineering challenges.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Reconfigurable Logic** | **08 HOURS** |

**Contents:** Overview of the VLSI design flow, Hardware Description Language: Types, Brief comparison of Hardware Description Languages, Introduction to CPLD and FPGA, Detailed discussion on configurable logic blocks, FPGA and SoC architectures, FPGA interconnect architecture and on-chip coarse-grain resources including BRAM, DSP, clock control

**Further Readings/Self Study:** CPLD and FPGA Architectures

| | | |
|---|---|---|
| **UNIT 2** | **Introduction to Verilog** | **06 HOURS** |

**Contents:** Introduction of Verilog language and basic Verilog syntax and semantics on Verilog using design examples, Program Structure, Logic System, Nets, Variables, Constants, Vectors & Operators, Arrays, Logical Operators & Expressions

**Further Readings/Self Study:** Verilog Constructs

| | | |
|---|---|---|
| **UNIT 3** | **Combinational and Sequential Logic Design with Verilog** | **06 HOURS** |

**Applications/Case Study:** Implementation of I2C/AMBA/SPI and related applications with Verilog

**Contents:** Hierarchical Modeling Concepts, data types, Modules and Ports, Gate-Level Modeling, Dataflow Modeling, Behavioral Modeling, Blocking and non-Blocking statements, Test Bench Generation

**Further Readings/Self Study:** Data Protocols

| | | |
|---|---|---|
| **UNIT 4** | **Digital Design synthesis and its optimization** | **06 HOURS** |

**Contents:** Coding Style: Best-Known Method for Synthesis with combinational and sequential logic circuits, Naming Convention, Design Partitioning, Clock, Reset, Latch Inference.

**Further Readings/Self Study:** Complex Digital Circuit

| UNIT 5 | System Verilog for Advanced Verification | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Verification of complex digital systems

**Contents:** Introduction to System Verilog for verification Verification: What is Verification, The Importance of Verification, Reconvergence Model Equivalence Checking Property Checking Functional Verification Functional Verification Approaches Testing Versus Verification Design and Verification Reuse Verification Technologies Linting, Simulation Code Coverage Functional Coverage Levels of Verification. Verification Vs Testing

**Further Readings/Self Study:** Verification of complex digital systems

| UNIT 6 | System-on-Chip (SoC) Design | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Develop an SoC Application-Image Processing/Audio Processing

**Contents:** SOC Design Flow, Processor Cores, Embedded Memory Core, SOC Design Requirements, IP Design, Development Plan, SoC- PS and PL and IP generation

**Further Readings/Self Study:** SoC Concept

## TEXT BOOKS


1. Samir Palnitkar (2003). *Verilog HDL: A Guide to Digital Design and Synthesis*. 2nd Edition, Prentice Hall PTR Publication. ISBN: 978-0132599702.
2. Ashok B Mehta (2018). *ASIC/SoC Functional Design Verification: A Comprehensive Guide to Technologies and Methodologies*. 1st Edition, Springer Publication.


## REFERENCE BOOKS


1. Wyane Wolf, (2008). *Modern VLSI Design (System on Chip)*. 13th Edition, Pearson Education. ISBN 9780137145003.
2. Janick Bergeron (2006). *Writing Testbenches using System Verilog*. 7th Edition, Springer Publication. ISBN 81 -7808-23.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Configurable Logic Design Lab |
| | **COURSE CODE** | 2307323L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :**

**COURSE OBJECTIVES :**

2307323L.CEO.1: To provide hands-on experience with reconfigurable architectures for design optimization.

2307323L.CEO.2: To improve coding skills in utilizing different Verilog coding styles.

2307323L.CEO.3: To enable students to verify digital circuits through practical exercises.

2307323L.CEO.4: To introduce the practical application of System on Chip platforms for constructing basic building blocks.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307323L.CO.1: Implement and test fundamental digital circuits such as Arithmetic Logic Units, counters, Finite State Machines, and memories using Verilog. [L3]

2307323L.CO.2: Develop Verilog code in various modeling styles (structural, dataflow, and behavioral) for specified digital circuits and analyze their operation through simulation. [L3]

2307323L.CO.3: Establish environments for verification with SystemVerilog for verification of digital circuits. [L4]

2307323L.CO.4: Design and implement a System on Chip (SoC) application by integrating basic building blocks. [L5]

**COURSE ABSTRACT:**

This course provides an introduction to the reconfigurable logic design, focusing on the use of Field-Programmable Gate Arrays (FPGAs) and Complex Programmable Logic Devices (CPLDs). Students will gain a comprehensive understanding of the VLSI design flow, Verilog as a hardware description language and advanced verification techniques using SystemVerilog. The course covers both theoretical concepts and practical demonstration which enables the students to design, implement, and verify complex digital systems. Key topics include combinational and sequential logic design, digital design synthesis and optimization, and System-on-Chip (SoC) design. Through hands-on lab sessions and case studies, students will develop the skills necessary to tackle real-world engineering challenges.

Practicals of the course are divided into A and B parts

Part A Practical 1 to 6 (any 5)

Modeling and Functional Simulation, synthesis and implementation on PLDs of the following digital circuits using Verilog Hardware Description Language.

Part B Practical 7 to 9 (any 2)

Verification of Digital Systems

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Combinational logic design** | **4 HOURS** |
| Design and implement 4 bit Arithmetic Logic Unit using Verilog | | |
| **PRACTICAL NO.02** | **Sequential Logic Design** | **4 HOURS** |
| Design and implement 4 bit up/down synchronous/asynchronous counter | | |
| **PRACTICAL NO.03** | **Sequence Detector** | **4 HOURS** |
| Design and implement Finite State Machine for given sequence | | |
| **PRACTICAL NO.04** | **Memory Implementation** | **4 HOURS** |
| Design and implement memories using Verilog | | |
| **PRACTICAL NO.05** | **System on Chip** | **4 HOURS** |
| SoC implementation for given digital logic | | |
| **PRACTICAL NO.06** | **FIFO** | **4 HOURS** |
| Design and implement FIFO using Verilog | | |
| **PRACTICAL NO.07** | **System Verification** | **4 HOURS** |
| Setup an environment for compilation and simulation for system Verilog | | |
| **PRACTICAL NO.08** | **System Verification** | **4 HOURS** |
| Setup an environment for Constrained Random test generation | | |
| **PRACTICAL NO.09** | **System Verification** | **4 HOURS** |
| Modeling and Verification of Digital Circuits using System Verilog | | |

## TEXT BOOKS


1. Samir Palnitkar (2003). *Verilog HDL: A Guide to Digital Design and Synthesis*. 2nd Edition, Prentice Hall PTR Publication. ISBN: 978-0132599702.
2. Ashok B Mehta (2018). *ASIC/SoC Functional Design Verification: A Comprehensive Guide to Technologies and Methodologies*. 1st Edition, Springer Publication.


## REFERENCE BOOKS


1. Wyane Wolf, (2008). *Modern VLSI Design (System on Chip)*. 13th Edition, Pearson Education. ISBN 9780137145003.
2. Janick Bergeron (2006). *Writing Testbenches using System Verilog*. 7th Edition, Springer Publication. ISBN 81 -7808-23.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Database Management System (DBMS) Lab |
| | **COURSE CODE** | 2307361L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307361L.CEO.1: Introduce the fundamental concepts of databases including data models, schemas and normalization.

2307361L.CEO.2: Demonstrate different types of database management systems such as relational and NoSQL databases.

2307361L.CEO.3: Design database by understanding requirements, creating entity-relationship diagrams, and converting them into relational schemas.

2307361L.CEO.4: Illustrate SQL and NoSQL queries to retrieve, insert, update, and delete data from databases.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307361L.CO.1: Summarize role and importance of a DBMS in managing and organizing large volumes of data efficiently [L2].

2307361L.CO.2: Develop problem-solving skills related to database schema, design, querying, and optimization by ensuring data integrity and efficiency [L3].

2307361L.CO.3: Demonstrate the different database management systems in a team that involve designing, implementing and querying databases, fostering communication and collaboration skills using modern tools [L3].

**COURSE ABSTRACT:**

Database Management System is a software system that is designed to manage and organize data in a structured manner from a database. Some popular databases are MySQL, Oracle, MongoDB, etc. DBMS provides many operations e.g. creating a database, Storing in the database, updating an existing database, delete from the database. DBMS is a system that enables you to store, modify and retrieve data in an organized way. It also provides security to the database. DBMS provides an environment to store and retrieve the data in convenient and efficient manner.

Database systems are meant to handle an extensive collection of information. Management of data involves both defining structures for storage of information and providing mechanisms that can do the manipulation of those stored information.

**PRACTICALS**

| MODULE NO.01 | Database Design | 12 HOURS |
|---|---|---|

- Data classification, Data lifecycle
- Purpose of database systems and applications
- View of Data: Data Abstraction, Instances and Schemas, Data Models
- Database languages
- Relational database
- Database Design: Design Process, Entity-Relationship Model

**Case Study:** Banking system, Student information system, University database, Shop management system, Data analysis for any social media platform, Employee database system

**Self Study:** Data mining and Data Warehouse Frameworks

| MODULE NO.02 | Structured Query Language (SQL) | 14 HOURS |
|---|---|---|

- Overview of the SQL Query Language
- Basic Structure of SQL Queries: Queries on a Single & Multiple Relation
- On any relational database case study, perform and execute;
  - Data Definition Query Language (DDL)
  - Data Manipulation Query Language (DML)
  - Data Control Query Language (DCL)
  - Intermediate SQL Features: Joins, Views, Integrity Constraints
  - Normalization
- Accessing SQL From a Programming Language

**Case Study:** Banking system, Student information system, University database, Shop management system, Data analysis for any social media platform, , Employee database system

**Platforms:**

MySQL Command Line Client or SQL Workbench or any cloud platform, Python IDE's: Jupyter Notebook, Google Colab, Pycharm etc.

| MODULE NO.03 | NoSQL | 14 HOURS |
|---|---|---|

- Overview of the NoSQL Query Language
- Basic Structure of NoSQL Queries
- On any NoSQL database case study, perform and execute queries like;
  - Create
  - Insert
  - Update
  - Delete
  - Aggregate Functions
- Accessing NoSQL From a Programming Language

**Case Study:** Banking system, Student information system, University database, Shop management system, Data analysis for any social media platform, , Employee database system

**Platforms:**
MongoDB Compass or any other platform, Python IDE's: Jupyter Notebook, Google Colab, Pycharm etc.

## TEXT BOOKS


1. Silberschatz, A., Korth, H., Sudarshan, S. (2019). *Database System Concepts*. 7th Edition, McGraw Hill Publishers. ISBN 9780078022159.
2. Elmasri, R., Navathe, S. (2017). *Fundamentals of Database Systems*. 7th Edition, Pearson Education. ISBN 9789332582705.
3. Shannon Bradshaw, Eoin Brazil, Kristina Chodorow. (2019). *MongoDB: The Definitive Guide: Powerful and Scalable Data Storage*. 3rd Edition, O'Reilly Media. ISBN 978-1491954461.


## REFERENCE BOOKS


1. Coronel, C., Steven Morris. (2018). *Database Systems: Design, Implementation & Management*. 13th Edition, Course Technology. ISBN 1337627909.
2. Date, C. (2002). *An Introduction to Database Systems*. 7th Edition, Pearson Education. ISBN 81-7808-23.
3. Rab P. Coronel C. (2002). *Database Systems Design, Implementation and Management*. 5th Edition, Thomson Course Technology, ISBN 981-243-135-7
4. Andreas Meier, Michael Kaufmann. (2019). *SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management*. 1st Edition, Springer Vieweg. ISBN 978-3658245481.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Linux for Embedded Systems Lab |
| | **COURSE CODE** | 2307362L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307362L.CEO.1: To explore the features of Linux for embedded system development.
2307362L.CEO.2: To deliver the practise on different programming skill sets in Linux Embedded Environment.
2307362L.CEO.3: To describe how to configure the Linux kernel and develop custom peripheral drivers.
2307362L.CEO.4: To make acquainted with industry standard hardware and software tools.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307362L.CO.1: Demonstrate the usage of different utilities in Linux environment [L3].
2307362L.CO.2: Use industry standard tools to configure and build an embedded Linux system stack [L2].
2307362L.CO.3: Develop kernel modules for customer peripherals [L3].
2307362L.CO.4: Debug, evaluate and profile embedded Linux systems using standard industry software [L5].
2307362L.CO.5: Design and develop an application on Linux embedded platform [L6].

**COURSE ABSTRACT:** (Brief description of course contents)

With the proliferation of Linux-based embedded systems across various industries, there's certainly a growing need for skilled professionals who can work with these systems effectively. Linux-based embedded systems are widely used in smartphones, in-vehicle infotainment systems, in countless consumer electronics and for numerous industrial applications. As a result, the demand for qualified embedded system engineers with the requisite experience in Linux is on the rise.

This course teaches how to configure the Linux kernel and develop custom peripheral drivers. Learners gain an understanding of the Linux architecture and acquire the practical skills involved in building an embedded Linux system, as well as debugging and profiling application performance. Looking at the industrial needs, this course consists of introduction to Linux and Embedded Systems, installation of Linux OS on desktop/ laptop machine and embedded platform, shell scripting, Make file utility, file handling, C and Python programming on Linux environment, Linux-based Embedded System Component Stack, Anatomy of a Linux-based System, Configuration and Build Process, Linux Kernel Modules, Communication Between Kernel and User Space, Application Demo: Building a Ranging Sensor Kernel Module, System Debugging and Profiling, capstone project.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Installation of Linux OS** | **4 HOURS** |
| Installation of a distro of Linux on Desktop/Laptop machine and workplace setup on an embedded platform | | |
| **PRACTICAL NO.02** | **Programming in Linux environment** | **4 HOURS** |
| Basic C programming and File handling programming in Linux environment | | |
| **PRACTICAL NO.03** | **Shell Scripting and Make Utility** | **4 HOURS** |
| Demonstration of Shell scripting and Make utility in Linux environment | | |
| **PRACTICAL NO.04** | **GPIO Interface on Linux Embedded Platform** | **4 HOURS** |
| Programming for GPIO interfacing on Embedded Linux platform | | |
| **PRACTICAL NO.05** | **Loadable Kernel Module** | **8 HOURS** |
| Development of loadable kernel module on embedded Linux platform | | |
| **PRACTICAL NO.06** | **Application Demonstration** | **4 HOURS** |
| Building a Ranging Sensor Kernel Module | | |
| **PRACTICAL NO.07** | **System Debugging and Profiling** | **8 HOURS** |
| Use of Arm Development Studio, Streamline tool to profile the execution of code running on the embedded Platform. | | |
| **PRACTICAL NO.08** | **Capstone Project Design and Implementation** | **8 HOURS** |
| Capstone project design, coding and development | | |

| PRACTICAL NO.09 | Capstone Project Demonstration and Presentation and Report Writing | 4 HOURS |
|---|---|---|
| Capstone Project Demonstration and Presentation | | |

## TEXT BOOKS


1. Daniel P. Bovet. *Understanding the Linux Kernel*. 3rd Edition, O'Reilly Publication. ISBN 978-0596005658
2. Karim Yaghmour, Jon Masters, Gilad Ben-Yossef, & Philippe Gerum *Building Embedded Linux systems*. 2nd Edition, O'Reilly Publication, ISBN-13: 978- 0596529680.
3. Chris Simmonds *Mastering Embedded Linux Programming* 2nd Edition, Packt Publication, ISBN - 978-1787283282.


## REFERENCE BOOKS


1. Frank Vasquez *astering Embedded Linux Programming*. 3rd Edition, Packt Publication. ISBN 978-1789530384
2. Alessandro Rubini & Jonath Corbet *Linux Device Drivers*. 3rd Edition, O'Reilly Publication, ISBN-13: ISBN: 978-0-596-00590-0
3. John Madieu *Linux Device Driver Development* 2nd Edition, Packt Publication, ISBN 978-1803240060.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Cyber Security Essentials |
| | **COURSE CODE** | 2306331T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2306331T.CEO.1: To understand the broad set of technical & social Challenges and Constraints of Cyber Security.

2306331T.CEO.2: To acquire the required skill to be applicable for the Operational and Organizational Security.

2306331T.CEO.3: To apply Cryptographic mechanisms.

2306331T.CEO.4: To implement information gathering techniques and tools

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2306331T.CO.1: Experiment with information gathering techniques and tools [L3].

2306331T.CO.2: Differentiate among different types of cyber threats and cyber-crimes [L4].

2306331T.CO.3: Distinguish the encryption and decryption techniques for real life applications [L4].

2306331T.CO.4: Identify Cyber Crime Issues & techniques for real life applications [L3].

**COURSE ABSTRACT:**

Cyber Security Essentials provides a comprehensive introduction to the fundamental concepts and practices in cyber security. This course is designed to equip students with essential knowledge and skills to understand the threats and vulnerabilities present in today's digital landscape and how to mitigate them effectively.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Cyber security** | **06 HOURS** |

**Applications/Case Study:** Network designing

**Contents:** Introduction: Introduction to Cyber Security, Need, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyber-warfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cyber security - Organizational Implications.

**Self-Study:** Computer Networking concepts

**Further Readings:** Cyber Information Act/s

| | | |
|---|---|---|
| **UNIT 2** | **CYBER Crimes and Hacking** | **06 HOURS** |

**Applications/Case Study:** Man in the Middle Attack

**Contents:** Overview of Cyber-Attacks and Vulnerabilities, Types of Threats Malware, spyware, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors.

Types of Cyber Crime - White collar Crimes, cyber stalking, forgery, software piracy, cyber terrorism, phishing, computer vandalism, computer hacking, creating and distributing viruses over internet, spamming, cross site scripting, online auction fraud, cyber-squatting, mail bombs, web jacking, internet time thefts, DoS attack, salami attack, data diddling, email spoofing. Types of Hacker Hacking and Cracking, Hacking: Ethical issues, Ethical Hacking.

**Self-Study:** Information gathering tools like google Dorking

**Further Readings:** Cyber security Laws & Policies

| | | |
|---|---|---|
| **UNIT 3** | **Introduction to Cryptography** | **06 HOURS** |

**Applications/Case Study:** Error detection and techniques

**Contents:** Basic Concept of Cryptography, Error detection and correction techniques, Algorithms - Hashing Functions, Introduction to Symmetric & Asymmetric Encryption

**Self-Study:** Differentiation In Symmetric & Asymmetric key algorithms

**Further Readings:** Cryptographic Algorithms

| | | |
|---|---|---|
| **UNIT 4** | **Intrusion Detection Systems** | **08 HOURS** |

**Applications/Case Study:** IDS applications

**Contents:** History of Intrusion Detection Systems, IDS Overview, Network-Based IDSs, Host-Based IDSs, Intrusion Prevention Systems, Honeypots and Honeynets.

Attacks in WSN: Introduction & challenges in intrusion detection in WSNs

**Self-Study:** Architecture of IDS for WSN

**Further Readings:** WSN Protocols

| UNIT 5 | Cyber Ethics and Laws | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Cyber Crime Issues

**Contents:** Introduction to Cyber Laws, E-Commerce and E-Governance, Certifying Authority and Controller, Offences under IT Act, Computer Offences and its penalty under ISO 27001, IT Act 2000, Positive Aspects and weak areas of ITA 2000, Digital signatures and the Indian ITA act, ITA 2008, and International Standards maintained for Cyber Security, Security Audit, Investigation by Investing Agency, Intellectual Property Rights in Cyberspace.

**Self-Study:** Digital laws and legislation

**Further Readings:** Cyber Ethics

## TEXT BOOKS


1. Nina Godbole and Sunit Belpure (2011). *Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*. 1st Edition, Wiley. ISBN 9788126521791.
2. B.B. Gupta, D.P. Agrawal and Haoxiang Wang (2018). *Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives*. CRC Press. ISBN 9780815371335.


## REFERENCE BOOKS


1. James Graham, Richard Howard and Ryan Otson (2010). *Cyber Security Essentials*. CRC Press. ISBN 1439851239.
2. Chwan-Hwa(john) Wu,J. David Irwin (2013). *Introduction to Computer Networks and Cybersecurity*. 1st Edition, CRC Press. ISBN 9781466572133.
3. Nelson Phillips and Enfinger Steuart (2022). *Computer Forensics and Investigations*. 1st Edition, Cengage Learning. ISBN 9353506263.
4. Kevin Mandia, Chris Prosise and Matt Pepe (2014). *Incident Response and Computer Forensics*. 3rd Edition, Tata McGraw-Hill. ISBN 9780071798686.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Cyber Security Essentials Lab |
| | **COURSE CODE** | 2306331L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2306331L.CEO.1: To understand the broad set of technical & social Challenges and Constraints of Cyber Security.

2306331L.CEO.2: To acquire the required skill to be applicable for the Operational and Organizational Security.

2306331L.CEO.3: To apply Cryptographic mechanisms.

2306331L.CEO.4: To implement information gathering techniques and tools

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2306231L.CO.1: To experiment with information gathering techniques and tools [L3].

2306231L.CO.2: Differentiate among different types of cyber threats and cyber-crimes [L4].

2306231L.CO.3: Distinguish the encryption and decryption techniques for real life applications [L4].

2306231L.CO.4: Identify Cyber Crime Issues & techniques for real life applications [L3].

**COURSE ABSTRACT:**

Cyber Security Essentials provides a comprehensive introduction to the fundamental concepts and practices in cybersecurity. This course is designed to equip students with essential knowledge and skills to understand the threats and vulnerabilities present in today's digital landscape and how to mitigate them effectively.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Ice breaking Sessions** | **4 HOURS** |
| Initial Labs/practical's will be focusing on the prerequisites like Number representation, Computer networking concepts like Network Designing, IP Addressing, etc. | | |
| **PRACTICAL NO.02** | **Network Analyzing tools** | **2 HOURS** |
| Study of packet sniffing using Wireshark | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Study of Linux and window network command | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Information gathering using: Shodan, Google Dorking and kali Linux etc. | | |
| **PRACTICAL NO.05** | | **4 HOURS** |
| Vulnerability analysis using SKIPFISH, NIKTO, Nessus | | |
| **PRACTICAL NO.06** | | **2 HOURS** |
| Study of Virus, worms, trojan | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Network exploitation using buggy web application, burp suite. | | |
| **PRACTICAL NO.08** | | **2 HOURS** |
| Password Cracking: study of application John the Ripper | | |
| **PRACTICAL NO.09** | **Case studies/Demonstrations** | **4 HOURS** |

1. To study Kerberos network authentication protocol
2. To study IT act 2000
3. Cyber Security Certificate Course on CISCO Net Academy
4. Cyber Security Certificate Course on Fortinet training

## TEXT BOOKS


1. Nina Godbole and Sunit Belpure (2011). *Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*. 1st Edition, Wiley. ISBN 9788126521791.
2. B.B. Gupta, D.P. Agrawal and Haoxiang Wang (2018). *Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives*. CRC Press. ISBN 9780815371335.


## REFERENCE BOOKS


1. James Graham, Richard Howard and Ryan Otson (2010). *Cyber Security Essentials*. CRC Press. ISBN 1439851239.
2. Chwan-Hwa(john) Wu,J. David Irwin (2013). *Introduction to Computer Networks and Cybersecurity*. 1st Edition, CRC Press. ISBN 9781466572133.
3. Nelson Phillips and Enfinger Steuart (2022). *Computer Forensics and Investigations*. 1st Edition, Cengage Learning. ISBN 9353506263.
4. Kevin Mandia, Chris Prosise and Matt Pepe (2014). *Incident Response and Computer Forensics*. 3rd Edition, Tata McGraw-Hill. ISBN 9780071798686.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Major Project - I |
| | **COURSE CODE** | 2307391L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307391L.CEO.1: To equip students with the ability to conduct thorough literature reviews, identifying relevant academic and industry sources.

2307391L.CEO.2: To introduce fundamental design principles and methodologies applicable to engineering and technology projects.

2307391L.CEO.3: To teach students the basics of creating models/designs to represent systems with modelling tools and software commonly used in industry and research.

2307391L.CEO.4: To understand how simulation tool can be used for iterative design improvement and optimization.

2307391L.CEO.5: To guide students how to communicate their project findings clearly and concisely through written reports.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307391L.CO.1: Apply mathematical, scientific, and engineering principles in the design and development of their projects [L3].

2307391L.CO.2: Analyze, and solve complex engineering problems, demonstrating proficiency in research methodologies and modern tools [L4].

2307391L.CO.3: Assess the societal and environmental impacts of their engineering solutions and incorporate ethical considerations into their projects [L5].

2307391L.CO.4: Communicate their project ideas and results effectively through presentations and reports, and work collaboratively in teams [L2].

2307391L.CO.5: Apply effective project management skills, including planning, resource allocation, and adherence to timelines, while engaging in continuous learning and improvement [L3].

## COURSE ABSTRACT:

The project is most important part of undergraduate curriculum and enables students to develop analytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Project Design, Project Implementation and Project Evaluation. The first phase of Project Design mainly focuses on formulating systems requirement, background/literature review, and defining scope, objective and apply project management/modeling tools to design proposed solution. This enables students to apply their technical acumen and innovativeness in proposing methodology, milestones, and expected outcome.

## GUIDELINES

1. Every project group should consist of minimum 03 and maximum of 04 students.
2. The group members may be from different programs to support the interdisciplinary functioning.
3. Project group members and title of the project need to be approved by Project Guide and School.
4. Projects should preferably have a national/international industry/academic/research collaboration.
5. User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
6. The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.

7. Define proposed solution and apply project management/modeling tools for project planning and design.
8. Critically analyze various solutions/techniques to solve real world problems and perform feasibility study to select and justify proposed solution.
9. Define outcome, milestones, definite roadmap for project design, implementation, evaluation and documentation.

**Collaborative/Sponsored Project**

1. Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for project work.
2. Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization, anytime before the commencement of the sixth semester.
3. Proposed Collaborative Project work need to reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of minimum 12 months to 18 months.
4. Final assessment will be carried out in presence of faculty mentor, external mentor and examiner.

**TIMELINE**

1. Exploration of fore front research/specialization areas and opportunities in the various fields.
2. Formation of Project Group. Finalization of area of work/title as per forefront areas.
3. Exploration of abridged courses, valid resources, challenges, relevance with current opportunities.
4. Background study Systematic literature review.
5. Literature review documentation for Project Report and Research Article.
6. Project Review I Presentation.
7. Define problem statement and objectives.
8. Define scope of the work and Outline of the work.
9. Project Design, Modelling, Simulation etc.
10. Proposed Methodology of the solution and its documentation.

11. Project Review II Presentation.
12. Project Documentation: Ethics in Writing
13. Project Documentation: Final Synopsis
14. Project Documentation: Project Report Writing

## ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Background Study and Literature Review (10 Marks)
2. Synopsis (5 Marks)
3. Project Review I: Problem Identification, Motivation, Relevance, Background Study, Literature Review (10 Marks)
4. Project Review II: Literature Review, Problem Definition, Project Planning, Analysis and Design (10 Marks)
5. Project Report (10 Marks)
6. Final Presentation and Demonstration (30 Marks)

## TEXT BOOKS


1. John M. Nicholas. (2012). *Project Management for Engineering, Business and Technology*. 4th Edition, Butterworth-Heinemann. ISBN 978-0080967042.
2. Leslie Lamport. (1994). LaTeX: *A document preparation system, Users guide and reference manual*. 2nd Edition, Addison-Wesley. ISBN 978-0201529838.


## REFERENCE BOOKS


1. Michelle Reid. (2018). *Report Writing (Pocket Study Skills)*. 2nd Edition, Bloomsbury Publishing. ISBN 978-0230376557.
2. Sara Efrat Efron and Ruth David. (2018). *Writing the Literature Review : A Practical Guide*. 1st Edition, Guilford Press . ISBN 978-1462536894 .

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Internship (Technical) |
| | **COURSE CODE** | 2307396L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | TUTORIAL/ | PRESENTATION/ | TOTAL |
| LECTURE | PRACTICAL | ICE | ECE | IA | CA | DEMONSTRATION | |
| NIL | NIL | NIL | NIL | NIL | 30 | 45 | 75 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2307396L.CEO.1: To enhance technical skills and self-directed learning.

2307396L.CEO.2: To develop adaptability and resilience in a multicultural or professional environment.

2307396L.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2307396L.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2307396L.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2307396L.CO.1: Develop and implement advanced technical competencies through hands-on training and industry-relevant technical certification programs, demonstrating expertise in applying acquired knowledge to solve complex challenges [L5].

2307396L.CO.2: Design and execute professional behavioural frameworks, integrating teamwork, time management, and ethical decision-making to address multifaceted technical and industrial scenarios [L6].

2307396L.CO.3: Evaluate and synthesize personal growth and adaptability by critically analysing experiential learning, technical training outcomes, and real-world industry exposure to inform strategic career decisions [L5].

2307396L.CO.4: Create innovative and actionable strategies to address emerging industry trends by conducting comprehensive analyses and integrating advanced technical and professional knowledge [L6].

2307396L.CO.5: Formulate and critically evaluate complex problem statements by integrating multidisciplinary approaches to develop and propose innovative, solution-driven methodologies for real-world challenges [L6].

2307396L.CO.6: Design and deliver professional technical presentations and comprehensive reports, effectively communicating advanced technical insights and solutions to diverse audiences, supported by technical certifications and practical expertise [L6].

## INTRODUCTION:

This internship is designed to equip second-year B.Tech. students with essential skills for personal and professional growth. The program emphasizes cultivating professionalism, technical expertise, and real-world problem-solving capabilities, enabling students to thrive in competitive and dynamic landscape. Through this immersive experience, students will develop a comprehensive skill set that includes technical knowledge applied through real-time projects, effective communication, teamwork, and adaptability.

A significant focus of the program is encouraging students to pursue technical certifications in core and emerging domains, thereby enhancing their technical competence and industry readiness. These certifications include, but are not limited to:

1. **Programming and Development:** Java, Python, C++, and Advanced Java.
2. **Database Management:** Oracle, SQL, and MongoDB.
3. **Engineering Design and Simulation:** Autodesk Revit, MATLAB, ANSYS, and AutoCAD.
4. **Process Simulation and Optimization:** Power BI, Tableau, and Excel Advanced Analytics.
5. **Data Analytics and Visualization:** Power BI, Tableau, and Excel Advanced Analytics.
6. **Cloud Computing and Automation:** AWS (Amazon Web Services), Microsoft Azure, and DevOps Essentials.
7. **AI and Machine Learning:** TensorFlow, PyTorch, and introductory courses in AI/ML applications.
8. **Digital Tools for Productivity:** Primavera P6 for project management and SolidWorks for design engineering.

By participating in this internship, students will gain hands-on experience in their chosen technical areas, actively apply theoretical knowledge to practical challenges, and build confidence in delivering solutions. The program also emphasizes collaboration and peer learning, helping students to develop essential teamwork skills.

Ultimately, this internship will prepare students not only for academic excellence but also for seamless transition into industry roles, ensuring they are equipped to meet future challenges and capitalize on career opportunities in their respective fields.

## SCOPE AND STRUCTURE OF SIP:

**Scope** The Student Internship Program in Technical Skills is designed for students entering the second year of the B.Tech. program, to be undertaken during the summer break after Semester IV. This program aims to provide opportunities for skill enhancement through global certifications, technical skills training, or industrial exposure. The internship focuses on helping students identify and engage with relevant learning platforms, small-scale industries, or training opportunities to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

Duration: 3 to 4 weeks (minimum of 100 hours).

Timeframe: Conducted during June-July of each academic year.

Nature of Internship:

1. Technical skills training programs.
2. Industrial training with companies or small-scale industries.
3. Certifications in core technical fields such as programming, database management, design, simulation, and data analysis.

Facilitation: MITAoE assists students in identifying and applying for appropriate internships aligned with the programs goals.

Mentorship: Each second-year student will be assigned their first-year mentor as their internship guide. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :** The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development.

**Student Development Focus :** Before selecting an internship option, second-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. The program places significant emphasis on pursuing technical certification programs in areas such as programming, database management, engineering design, simulation, data analytics, and more. These certifications will enhance students technical expertise and provide them with a competitive edge in the industry, preparing them for future academic and career success.

Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT SCHEME:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

**1. Biweekly Progress Reports (40 percent) :**

a) Students must submit a minimum of two progress reports during the internship period.

b) These reports will document the students activities, achievements, and challenges.

c) The reports will be reviewed and evaluated by the assigned second-year mentor.

**2. Detailed Project Report with Learning Outcomes (40 percent) :**

a) Upon completion of the internship, students are required to submit a detailed project report.

b) The report should highlight the activities undertaken, skills acquired, challenges addressed, and overall learning outcomes.

**3. Final Presentation with Certificate (20 percent) :**

a) Students will deliver a final presentation summarizing their internship experience and learning outcomes.

b) A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Embedded Edge AI |
| | **COURSE CODE** | 2307313T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307313T.CEO.1: To familiarize students with interrupt structure of ARM MCU.
2307313T.CEO.2: To make students understand different communication protocols.
2307313T.CEO.3: To make students aware about the industry standards followed.
2307313T.CEO.4: To familiarize students with data logging using sensors.
2307313T.CEO.5: To impart knowledge of EdgeAI tools and applications.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307313T.CO.1: Apply interrupts while programming the ARM based MCUs [L3].
2307313T.CO.2: Analyze the system requirements for communication protocols [L4].
2307313T.CO.3: Evaluate their designs as per the industry standards [L5].
2307313T.CO.4: Create sophisticated systems around 32-bit ARM MCUs [L6].
2307313T.CO.5: Create simple applications using EdgeAI tools [L6].

**COURSE ABSTRACT:**

This course provides an opportunity to explore and uncover the hidden potentials of high-performance low-power low-cost computational platforms dominating the world market today. The course curriculum covers the key concepts such as interrupts, exception handling, and most important communication protocols for different peripheral interfaces. The course focuses on ARM Cortex-M4 processor based MCU platform giving a comprehensive coverage to the hardware model along with the programming model. The course also delves deeper into some high-end applications integrating Embedded Systems with AI tools along with discussions on some useful case-studies and use-cases for EdgeAI applications.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Interrupt Structure in ARM Cortex-M4** | **08 HOURS** |

**Applications/Case Study:** Interrupt based event counter

**Contents:** Interrupts and its types, ARM Cortex-M4 Interrupt Structure, Nested Vectored Interrupt Controller (NVIC): Features, Interrupt Registers, Interrupt Vector Table, External interrupt/event controller, Exception and Interrupt handling, Wakeup Event Management, Read/Write Protection Unit.

**Further Readings/Self Study:** Polling vs Interrupt

| | | |
|---|---|---|
| **UNIT 2** | **Serial Communication Protocols** | **08 HOURS** |

**Applications/Case Study:** Industrial Automation Systems

**Contents:** Introduction to Communication Protocols; Features, advantages and limitations of SPI, I2C, USART communication protocols, configuration and programming of communication protocols in ARM Cortex-M4 based MCU, Master-Slave peripheral configuration, Comparison of different communication protocols.

**Further Readings/Self Study:** Study of CAN protocol standard.

| | | |
|---|---|---|
| **UNIT 3** | **Industry Standards for Embedded System** | **08 HOURS** |

**Applications/Case Study:** MISRA C: 2023 Automate MISRA Coding Standards Compliance.

**Contents:** Programming Standards for Embedded Systems: CIMSIS (Cortex Microcontroller Software Interface Standard), Embedded C Standards, ANSI-C, AUTOSAR (Automotive Open System Architecture), MISRA (Motor Industry Software Reliability Association).

**Further Readings/Self Study:** Difference between MISRA C and MISRA C++ standards.

| | | |
|---|---|---|
| **UNIT 4** | **Sensors and Data Logging** | **08 HOURS** |

**Applications/Case Study:** Sensors for Embedded Systems.

**Contents:** Sensors and their categorization, Sensor configuration, calibration and integration, Multi-Sensor interfacing using I2C bus, Introduction to NanoEdgeAI software tool and its configuration process.

**Further Readings/Self Study:** NanoEdgeAI tool for training Embedded System Models using Sensors.

| UNIT 5 | Embedded Edge AI Applications | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Image classification and anomaly detection with Embedded Edge AI tools.

**Contents:** Data acquisition and pre-processing for embedded AI models, Embedded Edge AI tools, Performance evaluation and optimization techniques, Deployment considerations for edge AI applications, Real-time AI applications on ARM Cortex-M4 based MCU.

**Further Readings/Self Study:** Design and train a flight model using EdgeAI tools.

## TEXT BOOKS


1. Yiu, J.(2013). *The Denitive Guide to ARM Cortex-M3 and Cortex-M4 Processors*. 3rd Edition, Newnes. ISBN 978-0124080829.
2. Sloss, A., Symes, D., Wright, C. (2014). *ARM System Developers Guide Designing and Optimizing System Software*. 1st Edition, Morgan Kaufmann Publishers. ISBN 1-55860-874-5.


## REFERENCE BOOKS


1. Mazidi, M., Chen, S., Ghaemi, E. (2018). *STM32 Arm Programming for Embedded Systems*. 6th Edition, Microdigitaled. ISBN 978-0997925944.
2. Norris, D. (2018). *Programming with STM32: Getting Started with the Nucleo Board and C/C++*. 6th Edition, McGraw Hill. ISBN 978-1260031317.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Embedded Edge AI Lab |
| | **COURSE CODE** | 2307313L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307313L.CEO.1: To familiarize students with interrupt structure of ARM MCU.
2307313L.CEO.2: To make students understand different communication protocols.
2307313L.CEO.3: To familiarize students with data logging using sensors.
2307313L.CEO.4: To impart knowledge of EdgeAI tools and applications.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307313L.CO.1: Apply interrupts while programming the ARM based MCUs [L3].
2307313L.CO.2: Analyze the system requirements for communication protocols [L4].
2307313L.CO.3: Create sophisticated systems around 32-bit ARM MCUs [L6].
2307313L.CO.4: Create simple applications using EdgeAI tools [L6].

**COURSE ABSTRACT:**

This course provides an opportunity to explore and uncover the hidden potentials of high-performance low-power low-cost computational platforms dominating the world market today. The course curriculum covers the key concepts such as interrupts, exception handling, and most important communication protocols for different peripheral interfaces. The course focuses on ARM Cortex-M4 processor based MCU platform giving a comprehensive coverage to the hardware model along with the programming model. The course also delves deeper into some high-end applications integrating Embedded Systems with AI tools along with discussions on some useful case-studies and use-cases for EdgeAI applications.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Interrupt Service Routines (ISRs)** | **4 HOURS** |

- Configuring and handling interrupts using the HAL library

Perform any two from following

1. Switching LED patterns via push-buttons using interrupt in CUBE IDE
2. Demonstration of Interrupts using Digital Sensor
3. Configuring Timers using interrupt
4. Configuring ADC using interrupt

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Serial Communication Protocols (Perform any Two)** | **4 HOURS** |

- Select USART and configure it for communication (sending sensor data to a PC)
- Develop code for transmitting sensor data and receiving commands from a terminal
- Interfacing a Temperature & Humidity Sensor using I2C protocol

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Familiarization with AI software Tool** | **2 HOURS** |

Familiarization with NanoEdge AI Studio.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Sensors and Data Logging** | **4 HOURS** |

Design a Datalogger code to send HTU21DF sensor data from ARM Cortex M to NanoEdge AI Studio on PC

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **Embedded Edge AI Applications** | **6 HOURS** |

- Interfacing a Light Sensor using I2C protocol
- Design a Datalogger code to send light sensor data from STM32 to NanoEdge AI Studio on PC
- Running a Data logger code and building a Light Classification project on NanoEdge AI Studio
- Design a Datalogger code to send light sensor data from STM32 to NanoEdge AI Studio on PC

| PRACTICAL NO.06 | Laboratory Project and Demonstration | 6 HOURS |
|---|---|---|

Demonstration and Presentation of implementation of Embedded Edge AI Application as per problem statement assigned.

- Air plane simulation using NanoEdge AI
- Car Driving performance detection using Nano Edge AI

## TEXT BOOKS


1. Yiu, J.(2013). *The Denitive Guide to ARM Cortex-M3 and Cortex-M4 Processors*. 3rd Edition, Newnes. ISBN 978-0124080829.
2. Sloss, A., Symes, D., Wright, C. (2014). *ARM System Developers Guide Designing and Optimizing System Software*. 1st Edition, Morgan Kaufmann Publishers. ISBN 1-55860-874-5.


## REFERENCE BOOKS


1. Mazidi, M., Chen, S., Ghaemi, E. (2018). *STM32 Arm Programming for Embedded Systems*. 6th Edition, Microdigitaled. ISBN 978-0997925944.
2. Norris, D. (2018). *Programming with STM32: Getting Started with the Nucleo Board and C/C++*. 6th Edition, McGraw Hill. ISBN 978-1260031317.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Digital Signal & Image Processing |
| | **COURSE CODE** | 2307314T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE:** NIL

**COURSE OBJECTIVES :**

2307314T.CEO.1: Understand and apply the core concepts of digital signal processing.
2307314T.CEO.2: Implement and analyze various signal processing algorithms.
2307314T.CEO.3: Perform image enhancement and restoration using digital techniques.
2307314T.CEO.4: Utilize advanced DSP and DIP techniques for specialized applications.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307314T.CO.1: Apply the fundamentals signal processing techniques on various types of signals [L3].
2307314T.CO.2: Analyze the 1D and 2D signals for real time application [L4].
2307314T.CO.3: Develop analytical skills to solve problems related to signal and image processing [L5].
2307314T.CO.4: Design filters for 1-D and 2-D signals using specific criteria [L5].

**COURSE ABSTRACT:**

This course provides a comprehensive introduction to the theories and applications of digital signal and image processing. It is designed to equip students with the foundational concepts and techniques necessary to analyze, process, and interpret digital signals and images. The course covers various methods and algorithms used in the digital manipulation of signals and images, emphasizing practical applications and real-world problem-solving.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Fundamentals of Digital signal Processing** | **08 HOURS** |

**Applications/Case Study:** Real-Time ECG Signal Processing for Heartbeat Detection

**Contents:** 1-D signal processing: Convolution, LTI system, DTFT, Sampling and reconstruction, Sampling theorem, aliasing, Up Sampling and Down sampling, DFT: Computational complexity, properties, FFT: DIT and DIF algorithm, Long data filtering.

**Further Readings/Self Study:** Online DSP Simulations and Demos.

| | | |
|---|---|---|
| **UNIT 2** | **Filter Design** | **08 HOURS** |

**Applications/Case Study:** Prepossessing 1-D signal -Noise removal in audio/ ECG signals

**Contents:**IIR filter design: Analog filter design : Butterworth filters, digital technique-BLT/IIM of filter design. FIR filter: Linear phase filter, FIR filleter design :Fourier series method, window method

**Further Readings/Self Study:** Multirate Signal Processing:Decimation and Interpolation

| | | |
|---|---|---|
| **UNIT 3** | **Image Processing fundamentals** | **08 HOURS** |

**Applications/Case Study:** Auto image enhancement techniques

**Contents:** Image representation, Image models, image types, Image enhancement techniques, Spatial domain filtering, 2D DFT, frequency domain filtering

**Further Readings/Self Study:** Engage with the Kaggle community by participating in image processing and computer vision competitions.

| | | |
|---|---|---|
| **UNIT 4** | **Image analysis and feature extraction** | **08 HOURS** |

**Applications/Case Study:** Applications like ”counting of blood cells”

**Contents:** Image segmentation: Point. edge, line detection. Region growing and splitting. Feature extraction: Boundary pre-processing, Boundary/region feature descriptors. morphological operations: Dilation erosion, region filling , Hit and miss transform. Image restoration: image degradation models, noise model, Restoration in presence of noise.

**Further Readings/Self Study:** Python, along with libraries such as OpenCV, NumPy, SciPy, and scikit-image, provides robust tools for image processing.

| | | |
|---|---|---|
| **UNIT 5** | **Applications of 1D and 2D signal processing** | **08 HOURS** |

**Applications/Case Study:** Using FFmpeg for Video Processing

**Contents:**Audio processing: Noise removal, Silence removal, biomedical signal: Visualization , Noise removal, bio-metric recognition.

**Further Readings/Self Study:** Study Groups and Forums e.g. Stack Overflow: Tags like signal-processing and image-processing.

## TEXT BOOKS


1. Proakis, J. G. (2007). Digital signal processing: principles, algorithms, and applications, 4/E. Pearson Education India. .
2. Kumar, A. A. (2014). Digital signal processing,2/E PHI Learning Pvt. Ltd.
3. Gonzalez, R. C. (2009). Digital image processing, 4/E Pearson education india..


## REFERENCE BOOKS


1. Mitra, S. K., & Kuo, Y. (2006). Digital signal processing: a computer-based approach. New York: McGraw-Hill Higher Education.
2. Salivahanan, S., Vallavaraj, A., & Gnanapriya, C. (2001). Digital Signal Processing, McGraw-Hill..
3. Jayaraman, S., Esakkirajan, S., & Veerakumar, T. (2009). Digital image processing . New Delhi: Tata McGraw Hill Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Digital Signal & Image Processing Lab |
| | **COURSE CODE** | 2307314L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307314L.CEO.1: Develop technical proficiency with hands-on experience in implementing digital signal processing (DSP) and image processing techniques using industry-standard tools.

2307314L.CEO.2: Implement and test,various DSP and image processing algorithms.

2307314L.CEO.3: Cultivate the ability to analyze and interpret the results of signal and image processing experiments.

2307314L.CEO.4: Promote teamwork and effective communication through group projects and presentations.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307314L.CO.1: Implement digital filters (low-pass, high-pass, band-pass) and noise reduction techniques [L3].

2307314L.CO.2: Perform basic and advanced image processing operations, including enhancement, filtering, segmentation, and feature extraction [L3].

2307314L.CO.3: Analyze and interpret the results of experiments to make informed decisions about the effectiveness of different signal and image processing techniques [L4].

2307314L.CO.4: Design and implement practical solutions to real-world signal and image processing problems through individual and group projects [L5].

**COURSE ABSTRACT:**

The Digital Signal & Image Processing Lab course is designed to provide hands-on experience with the fundamental techniques and tools used in the analysis, manipulation, and synthesis of digital signals and images. This lab course complements theoretical knowledge with practical skills, preparing students for real-world applications in areas such as telecommunications, multimedia, medical imaging, and computer vision.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Signal Representation and Basic Operation** | **2 HOURS** |
| Learn basic 1-D signal representation. Read, display, save signals and perform basic operations like resizing, cropping, interpolation, decimation and delaying etc. | | |
| **PRACTICAL NO.02** | **Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT)** | **2 HOURS** |
| Perform Fourier analysis (DFT or FFT) on the composite signal to identify frequency components. Plot the frequency spectrum and analyze the results. | | |
| **PRACTICAL NO.03** | **IIR filter** | **2 HOURS** |
| Design IIR filter | | |
| **PRACTICAL NO.04** | **FIR filter** | **2 HOURS** |
| Design FIR filter | | |
| **PRACTICAL NO.05** | **Image Representation and Basic Operations** | **2 HOURS** |
| Learn basic image representation and manipulation like cropping , rotation,zooming etc. | | |
| **PRACTICAL NO.06** | **Image Enhancement in spatial domain** | **4 HOURS** |
| Image Enhancement in spatial domain technique : Negation,Contrast Stretching ,Morphological Operations. | | |
| **PRACTICAL NO.07** | **Image Enhancement in frequency domain** | **2 HOURS** |
| Image Enhancement in frequency domain technique : Image Filtering (Median, LPF, HPF ,High boost filtering). | | |
| **PRACTICAL NO.08** | **Edge detection** | **2 HOURS** |
| Implementing edge detection algorithms such as Sobel, Prewitt, and Canny to identify edges in images. | | |
| **PRACTICAL NO.09** | **Image Segmentation** | **2 HOURS** |
| Implementing segmentation algorithms to partition images into meaningful regions. | | |
| **PRACTICAL NO.10** | **Feature Extraction** | **2 HOURS** |
| Find the Fourier Descriptor (FD) that represents the shape of an object's boundary as a series of complex Fourier coefficients. | | |

| PRACTICAL NO.11 | Laboratory Project and Demonstration | 4 HOURS |
|---|---|---|

Demonstration of Laboratory project implementing DSP & DIP algorithms Develop a simple GUI (Graphical User Interface).Document the project thoroughly, including explanations of implemented algorithms, code comments, and user instructions. .

## TEXT BOOKS


1. Proakis, J. G. (2007). Digital signal processing: principles, algorithms, and applications, 4/E. Pearson Education India. .
2. Kumar, A. A. (2014). Digital signal processing,2/E PHI Learning Pvt. Ltd.
3. Gonzalez, R. C. (2009). Digital image processing, 4/E Pearson education india..


## REFERENCE BOOKS


1. Mitra, S. K., & Kuo, Y. (2006). Digital signal processing: a computer-based approach . New York: McGraw-Hill Higher Education.
2. Salivahanan, S., Vallavaraj, A., & Gnanapriya, C. (2001). Digital Signal Processing, McGraw-Hill..
3. Jayaraman, S., Esakkirajan, S., & Veerakumar, T. (2009). Digital image processing. New Delhi: Tata McGraw Hill Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2028 - 2029 (Rev. 2023 (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Introduction to Security of Cyber Physical Systems |
| | COURSE CODE | 2307324T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307324T.CEO.1: To acquaint the students with taxonomy and terminology of the Cyber-Physical System.
2307324T.CEO.2: To acquire the required skill to analyze Risk & Attacks in the CPS system.
2307324T.CEO.3: To apply Authentication and authorization mechanisms for the CPS.
2307324T.CEO.4: To introduce the Secure Deployment of CPS.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307324T.CO.1: Illustrate Authentication and authorization mechanisms. [L3]
2307324T.CO.2: Classify various Security Protocols & Standards used in the CPS. [ L4]
2307324T.CO.3: Distinguish the CPS - Platforms for real life applications [L4]
2307324T.CO.4: Evaluate the effectiveness of security measures in mitigating risks associated with CPS deployment. [L4]

**COURSE ABSTRACT:**

Cyber Physical System is one of the major areas that gain significance in these days for effective control, monitoring and management. The CPS infrastructures are targeted by the attackers for various reasons to bring down the service thus directly affects the mass population of a country. It is necessary to train and create manpower to protect the CPS. This course will cover the CPS basics, Vulnerabilities, Risk assessment & mitigation and security perspective.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Cyber-Physical Systems** | **06 HOURS** |

**Applications/Case Study:** Application of Cyber-Physical System

**Contents:** Definition and characteristics, Examples and applications, Features of Embedded System, Difference between Cyber-Physical Systems & Embedded System, Challenges and opportunities.

**Further Readings/Self Study:** Difference between Cyber-Physical Systems & IoT, Free Certification Courses in Cyber Security

| | | |
|---|---|---|
| **UNIT 2** | **Fundamentals of Cybersecurity** | **10 HOURS** |

**Applications/Case Study:** Threat Identification & Analysis

**Contents:** Introduction to Physical Security, factors on which Physical Security depends, Layers of Physical Security, Protection techniques. Stages for securing the CPS systems, attacks at the Perception layer, attacks at the transport layer, attacks at the application layer. Basic concepts: confidentiality, integrity, availability (CIA), Threats and attack vectors. CPS risk assessment: asset identification, threat identification, vulnerability identification.

**Further Readings/Self Study:** Risk mitigation strategies, Intrusion detection and prevention systems

| | | |
|---|---|---|
| **UNIT 3** | **Securing IoT Devices and Security Protocols and Standards** | **08 HOURS** |

**Applications/Case Study:** : Implement basic encryption and authentication mechanisms

**Contents:** Introduction to IoT architecture, IoT security challenges and solutions. Authentication and authorization mechanisms, Encryption techniques, Standards like OPC UA, DNP3, IEC 61850, Modbus/TCP, TLS, *IEEE 802.1X, ISA/IEC 62443.

**Further Readings/Self Study:** MQTT Protocol, Industrial Network Protocols

| | | |
|---|---|---|
| **UNIT 4** | **CPS Platforms and Secure Deployment of CPS** | **10 HOURS** |

**Applications/Case Study:** Cyber-Physical System Modeling, Cryptographic Mechanisms

**Contents:** Basic principles of design and validation of CPS, CPS Hardware platforms - Processors, Sensors, Actuators, CPS Network - Wireless Hart, CAN, Automotive Ethernet, CPS Software stack - RTOS, Scheduling Real Time control tasks. Secure Deployment of CPS: Attack models, Secure Task mapping and Partitioning, State estimation for attack detection

**Further Readings/Self Study:** Wireless Standards, Challenges & Solutions in CPS deployment, Industry 4.0, AutoSAR & Analysis of recent cyber-physical attacks

| UNIT 5 | Security in Real-World CPSs | 06 HOURS |
|---|---|---|

**Applications/Case Study:** CPS in Industrial Automation, Smart Cities

**Contents:** Real World uses of cyber-physical systems: Smart Grid, automobiles, and mobile healthcare delivery.

**Further Readings/Self Study:** Future Trends in CPS, Network Security Protocols

## TEXT BOOKS


1. 1.Edward Ashford Lee and Sanjit Arunkumar Seshia, (2017) Introduction to Embedded Systems, 2nd edition, MIT Press, ISBN: 978-0-262-53381-2.
2. Rajiv Alur, (2015) Principles of Cyber-Physical Systems, MIT Press. ISBN: 978-0-262-02911-7.


## REFERENCE BOOKS


1. Sajal K. Das, Krishna Kant and Nan Zhang Handbook on Securing Cyber-Physical Critical Infrastructure (2012, Morgan Kaufmann)
2. Jeeva Jose, Vijo Mathew (2022) Introduction to Security of Cyber-Physical Systems,1st edition, Khanna Publications,ISBN: 978-9355380586.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2028 - 2029 (Rev. 2023 (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Introduction to Security of Cyber Physical Systems Lab |
| | COURSE CODE | 2307324L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307324L.CEO.1: To acquaint the students with taxonomy and terminology of the Cyber-Physical System.
2307324L.CEO.2: To acquire the required skill to analyze Risk & Attacks in the CPS system.
2307324L.CEO.3: To apply Authentication and authorization mechanisms for the CPS.
2307324L.CEO.4: To introduce the Secure Deployment of CPS.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307324L.CO.1: Illustrate Authentication and authorization mechanisms. [L3]
2307324L.CO.2: Classify various Security Protocols & Standards used in the CPS.[ L4]
2307324L.CO.3: Distinguish the CPS - Platforms for real life applications [L4]
2307324L.CO.4: Evaluate the effectiveness of security measures in mitigating risks associated with CPS deployment. [L4]

**COURSE ABSTRACT:**

Cyber Physical System is one of the major areas that gain significance in these days for effective control, monitoring and management. The CPS infrastructures are targeted by the attackers for various reasons to bring down the service thus directly affects the mass population of a country. It is necessary to train and create manpower to protect the CPS. This course will cover the CPS basics, Vulnerabilities, Risk assessment & mitigation and security perspective.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **CISCO Packet Tracer** | **4 HOURS** |

1: Basic Security configuration commands
2: Configuration of AAA Authentication on Cisco Routers

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **IoT Programming (any 2)** | **6 HOURS** |

1. Implementation of Error Detection / Error Correction Techniquessingle bit, multiple bits, parity check, etc.
2. Write a program for Error Detection using CRC-CCITT
3. Data Encryption and Decryption - -Program to implement One Time Pad Cipher

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Network Analyzing tools** | **8 HOURS** |

1. To install & demonstrate nmap
2. Configure Port Scanning using nmap
3. Installation and demonstration of Wireshark Network Analyzer tool
4. To demonstrate the use of Wireshark network analyzer to sniff for router traffic

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Case studies/Demonstrations** | **4 HOURS** |

1. To study Kerberos network authentication protocol
2. To study IT act 2000
3. Cyber Security Certificate Course on CISCO Net Academy
4. Cyber Security Certificate Course on Fortinet training

**TEXT BOOKS**


1. Edward Ashford Lee and Sanjit Arunkumar Seshia, (2017) Introduction to Embedded Systems, 2nd edition, MIT Press, ISBN: 978-0-262-53381-2.
2. Rajiv Alur, (2015) Principles of Cyber-Physical Systems, MIT Press. ISBN: 978-0-262-02911-7.
3. Prinkle Sharma and Sanjay Goel , (2023), World Scientific Series in Digital Forensics and Cybersecurity: Volume 3- A Practical Guide on Security and Privacy in Cyber-Physical Systems Foundations, Applications and Limitations ISBN: 978-981-12-7355-1.

## REFERENCE BOOKS


1. Sajal K. Das, Krishna Kant and Nan Zhang Handbook on Securing Cyber-Physical Critical Infrastructure (2012, Morgan Kaufmann) [10.1016$_B$978 − 0 − 12 − 415815 − 3.00001 − 7] - libgen.li
2. Jeeva Jose, Vijo Mathew (2022) Introduction to Security of Cyber-Physical Systems,1st edition, Khanna Publications,ISBN: 978-9355380586.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Power Electronics in Electric Mobility |
| | **COURSE CODE** | 2307325T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** EV Architecture and Vehicle Dynamics

## COURSE OBJECTIVES :

2307325T.CEO.1: To demonstrate fundamental principles in power electronics semiconductor devices, circuit configurations, and switching processes .

2307325T.CEO.2: To develop the ability to understand and analyze power electronic converters circuits

2307325T.CEO.3: To make understand the basics of motor and drives used in an electrical vehicle application.

2307325T.CEO.4: To introduce the protection of power devices and its drive circuits

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307325T.CO.1: Illustrate construction of power diodes, thyristors, MOSFETs, IGBTs and their characteristics in different operating conditions [L2].

2307325T.CO.2: Design of power electronic converter circuits for EV applications [L3]

2307325T.CO.3: Analyze the control strategies for BLDC and PMSM motor drives, including regenerative braking and FOC [L4]

2307325T.CO.4: Explain the protection of power devices and its drive circuits[L3]

**COURSE ABSTRACT:** (Brief description of course contents)

This course focuses on the role of power electronics in Electric Vehicles (EVs), emphasizing semiconductor devices and their applications. It covers the characteristics of uncontrolled, semi-controlled, and fully controlled semiconductors, and their use in rectifiers, inverters, and chopper circuits. The course also explores converter topologies and control techniques, providing students with a comprehensive understanding of the power section of EVs. Additionally, it covers the operation and control strategies of motors used in EVs. Case studies offer practical insights into the design and use of power converters in EVs, equipping students with the knowledge to analyze and design power systems for electric vehicles.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Power Semiconductor Devices** | **08 HOURS** |

**Application :** Applications of power devices for electric vehicle
**Contents:** Construction, V-I Characteristics of Power Diode, SCR, MOSFET,TRIAC and IGBT, selection criteria, methods of firing/triggering power devices.
**Further Readings:** Role of power devices in EV inverter & UPS

| | | |
|---|---|---|
| **UNIT 2** | **Controlled Rectifiers** | **08 HOURS** |

**Application:** EV battery charging
**Contents:** Introduction to AC to DC converter, Single phase half wave and full wave, Three Phase half wave and full wave rectifier circuits with/ without, input/load inductance, power factor improvement.
**Further Readings:**Fly back Converter, Dual Converter

| | | |
|---|---|---|
| **UNIT 3** | **Choppers and Inverters** | **08 HOURS** |

**Case Study:** Hybrid energy sources for EV
**Contents:**Buck, boost, buck-boost, bidirectional DC to DC converter,DC-AC converter-Types, Single phase (half and full bridge), three phase voltage source inverters (120/180 mode)
**Self Study:** Isolated/ non-Isolated DC-DC Converter

| | | |
|---|---|---|
| **UNIT 4** | **Motor drives in EV** | **08 HOURS** |

**Application:** Future Trends in EV Motors
**Contents:** BLDC motor drive and speed control strategy, regenerative breaking of BLDC drives, PMSM drive and control strategies,Field oriented control of PMSM drive
**Self Study:** Switched Reluctance motor and its application in EV .

| | | |
|---|---|---|
| **UNIT 5** | **Protection of Power devices and its drive circuits** | **08 HOURS** |

**Application:** Future Trends in EV MotorBrushless motor and drives for EVs
**Contents:** Overcurrent Protection, Overvoltage Protection, di/dt and dv/dt protection circuits and design. Thermal management (cooling techniques and heat sink design), Electro- magnetic interference such as radiated and conducted EMI, Shielding techniques for EMI,
**Self Study:** Various EMI and EMC standards applicable to EV .

## TEXT BOOKS


1. . M. H. Rashid, Power Electronics circuits, devices and applications, 3rd edition, Pearson Education, 2014, ISBN-13: 978-93325357704

2. Robert W. Erickson, Fundamentals of Power Electronics, 2nd Edition, Kluwer Academic Publishers, 2001, ISBN-13: 978-0792372707

3. James Larminie and John Lowry Electric Vehicle Technology Explained, 2nd Edition, Wiley Publication, 2012, ISBN: 978-1-119-94273-3. .


## REFERENCE BOOKS


1. U. R. Moorthi, Power Electronics, Devices, Circuits & Industrial Applications, Oxford University Press India; 1st Edition, 2005, ISBN: 978-0195670929 .

2. M. S. Jamil Asgar, Power Electronics, PHI Learning Private Limited-New Delhi; 1st Edition, 2004, ISBN: 978-8120323964

3. D. P. Kothari, Renewable Energy Sources and Emerging Technologies, PHI Learning Private Limited-New Delhi; 2nd edition, 2011, ISBN: 978-8120344709

4. Mehrdad Ehsani, Yimin Gao and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, Standards media, 2009, ISBN: 978-1420053982.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2028 - 2029 (Rev. 2023 (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Power Electronics for Electric mobility Lab |
| | COURSE CODE | 2307325L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307325L.CEO.1: To understand the characteristics of Power Electronic devices
2307325L.CEO.2: To make use of the semiconductor devices in different power electronics converters.
2307325L.CEO.3: To introduce motor modelling and control simulation. .

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307325L.CO.1: : Analyze the voltage-current characteristics and switching behavior of power devices[L4] .
2307325L.CO.2: Design various power converters used in EVs like control rectifiers, DC-DC and DC-AC converters. [L3]]
2307325L.CO.3: Evaluate the performance and efficiency of single-phase and three-phase inverters, and BLDC motor speed control systems [L5]

**COURSE ABSTRACT:**

The course is a beginner-level course designed to introduce students to power electronics used in Electric vehicles and give them a brief idea about electric vehicles, and its importance. This course gives some basic technical foundations regarding power electronics In-order to help them move on to advanced level.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Characteristics of SCR,TRIAC** | **4 HOURS** |
| Analyze the characteristics of a Silicon Controlled Rectifier (SCR,TRIAC) by studying its V-I relationship for varying gate currents, identifying key parameters such as latching current and holding current, Break over Voltage, Forward Voltage Drop of SCR. | | |
| **PRACTICAL NO.02** | **Characteristics of MOSFET** | **2 HOURS** |
| Analyze the characteristics of a MOSFET by studying its transfer and output characteristics for varying gate voltages. Investigate key parameters such as threshold voltage, drain current, and on-resistance under different operating conditions. | | |
| **PRACTICAL NO.03** | **Control of rectifier circuits.** | **4 HOURS** |
| Design and implement signal-phase half-wave and full-wave controlled rectifiers with resistive (R) loads to control the output voltage using phase control (SCRs) and Pulse Width Modulation (PWM). | | |
| **PRACTICAL NO.04** | **DC-DC Converter for EV Battery Charging.** | **4 HOURS** |
| Design and implement a DC-DC converter (buck or boost converter) to charge an electric vehicle's battery by stepping up or stepping down the voltage. | | |
| **PRACTICAL NO.05** | **Regenerative Braking System with DC-DC Converter** | **4 HOURS** |
| Design and simulate a regenerative braking system to recover energy during braking. | | |
| **PRACTICAL NO.06** | **Single Phase Inverter** | **2 HOURS** |
| Evaluate the performance of a single-phase full bridge inverter. | | |
| **PRACTICAL NO.07** | **Three Phase inverter for commutation of Brushless DC motor of EV** | **4 HOURS** |
| Evaluate the performance of a Three -phase full bridge inverter. | | |
| **PRACTICAL NO.08** | **BLDC Motor speed control in MATLAB SIMULINK** | **2 HOURS** |
| Evaluate the performance and control of a Brushless DC (BLDC) motor using MATLAB Simulink. | | |

## TEXT BOOKS


1. . M. H. Rashid, Power Electronics circuits, devices and applications, 3rd edition, Pearson Education, 2014, ISBN-13: 978-93325357704

2. Robert W. Erickson, Fundamentals of Power Electronics, 2nd Edition, Kluwer Academic Publishers, 2001, ISBN-13: 978-0792372707

3. James Larminie and John Lowry Electric Vehicle Technology Explained, 2nd Edition, Wiley Publication, 2012, ISBN: 978-1-119-94273-3. .


## REFERENCE BOOKS


1. U. R. Moorthi, Power Electronics, Devices, Circuits & Industrial Applications, Oxford University Press India; 1st Edition, 2005, ISBN: 978-0195670929 .

2. M. S. Jamil Asgar, Power Electronics, PHI Learning Private Limited-New Delhi; 1st Edition, 2004, ISBN: 978-8120323964

3. D. P. Kothari, Renewable Energy Sources and Emerging Technologies, PHI Learning Private Limited-New Delhi; 2nd edition, 2011, ISBN: 978-8120344709

4. Mehrdad Ehsani, Yimin Gao and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, Standards media, 2009, ISBN: 978-1420053982.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | CMOS VLSI Design |
| | **COURSE CODE** | 2307326T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307326T.CEO.1: To introduce the fundamentals of CMOS VLSI technology for designing combinational/sequential logic circuits.

2307326T.CEO.2: To explain the layout design rules, layout techniques and the process steps in fabricating CMOS circuits.

2307326T.CEO.3: To demonstrate the VLSI design flow from RTL to GDS-II.

2307326T.CEO.4: To elaborate on DFT (Design For Testability) principles and the approaches to incorporate those at the chip design stage.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307326T.CO.1: Design the basic combinational/ sequential circuits using CMOS technology.[L4].

2307326T.CO.2: Draw the paper designs for the layouts of combinational circuits considering the lambda DRC rules based on fabrication process limitations. [L4] .

2307326T.CO.3: Explain logically the steps involved in CMOS VLSI Design flow. [L3] .

2307326T.CO.4: Identify the fault model/s of a faulty CMOS circuit design and apply the basic approach of DFT to render the design fault free.[L3].

**COURSE ABSTRACT:**

This course provides comprehensive knowledge of CMOS technology and VLSI fabrication processes. It integrates theoretical and practical aspects of modern semiconductor engineering, emphasizing the complete fabrication process with a focus on design rules, power distribution techniques, and layout constraints. Advanced topics such as design sign-off and design for testability (DFT) are also included, covering various testing techniques and fault models. This curriculum equips students with the skills needed to tackle real-world challenges in VLSI design, fabrication, and testing.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **CMOS Technology** | **08 HOURS** |

**Applications/Case Study:** Comparative analysis of different VLSI device technologies

**Contents:**ASIC Design flow

CMOS Technology, CMOS Inverter, CMOS Combinational Logic Design

MOSFET Parasitic, Technology Scaling, Channel Length Modulation, Hot Electron Effect, Velocity Saturation. Pass Transistors, Transmission Gate, Body Effect

**Further Readings/Self Study:** FinFET and Spin FET

| | | |
|---|---|---|
| **UNIT 2** | **Fabrication Process** | **08 HOURS** |

**Applications/Case Study:** Study of available fabrication Labs in India

**Contents:** CMOS Fabrication, Design Rules for NMOS and CMOS Technologies as Constraints for Layouts, Stick Diagram, Lambda Rules Power dissipation, Power distribution techniques, Jitter and skew, Power delay Product, Signal Integrity.

**Further Readings/Self Study:** DRC check and associated rules

| | | |
|---|---|---|
| **UNIT 3** | **RTL to GDS-II Flow** | **08 HOURS** |

**Applications/Case Study:**Identification of available Technology Files and corresponding library files

**Contents:** Introduction to Physical Design Automation, Partitioning, Floor planning, Power planning, I/O planning Placement, Routing (Grid Routing, global routing, detailed Routing), Clock Tree Synthesis Clock Design and Clock Routing.

SPICE Modeling

**Further Readings/Self Study:** ASIC Design

| | | |
|---|---|---|
| **UNIT 4** | **Physical Verification and Design Sign-off** | **08 HOURS** |

**Applications/Case Study:** Study of GDSII and netlist file formats

**Contents:** Design sign off techniques, PVS Introduction, Electrical Rule Checking, Layout versus Schematic check, Antenna check, Verification Tools..

**Further Readings/Self Study:** Sign off

| | | |
|---|---|---|
| **UNIT 5** | **Design for Testability** | **08 HOURS** |

**Applications/Case Study:** Role of DFT in ASIC Design Flow

**Contents:**Types of Fault, Need of Design for Testability (DFT), Testability, Difference between testing and verification, Path Sensitizing, Sequential Circuit Test, BIST, Test Pattern Generation, JTAG & Boundary Scan, TAP Controller. Metastability and Solution.

**Further Readings/Self Study:**Design Flow analysis

## TEXT BOOKS


1. C. Y. Chang and S. M. Sze (1996). *VLSI Technology*. 2nd Edition, McGraw Hill Publishers. ISBN 9780070627352
2. Andrew B. Kahng, Jens Lienig, Igor L. Markov, Jin Hu (2022). *VLSI Physical Design: From Graph Partitioning to Timing Closure*. 2nd Edition, Pearson Education.ISBN 9783030964153
3. J. Bhashkar and Rakesh Chadha (2009) *Static Timing Analysis for Nanometer Designs*, Springer Publication.
4. Robert J. Brown (2005). *Design for Testability for Digital ICs,*. 1st Edition, Wiley-Interscience. ISBN 9780471572955
5. Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic (2014). *Digital Integrated Circuits: A Design Perspective,*. 2nd Edition, Prentice Hall. ISBN 9789332573925


## REFERENCE BOOKS


1. S.K. Ghandhi (2008). *VLSI Fabrication principles*. John Wiley . ISBN 9788126517909.
2. Sung-Mo Kang and Yusuf Leblebici (2007). *Physical Design Essentials: An ASIC Design Implementation Perspecti*. Springer. ISBN 9780387461151.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | CMOS VLSI Design Lab |
| | **COURSE CODE** | 2307326L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307326L.CEO.1: To Compresence the knowledge of CMOS and other VLSI technologies for combinational circuits.

2307326L.CEO.2: To design layout for given digital circuit.

2307326L.CEO.3: To enable students for digital sequential and combinational circuit design with SPICE.

2307326L.CEO.4: To impart the knowledge of the placement and routing algorithms.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307326L.CO.1: Analyze the performance of CMOS circuits [L3].

2307326L.CO.2: Design layouts of combinational circuits for specific technology node with CAD tools [L4].

2307326L.CO.3: Investigate the circuit behavioral change which depends on device model parameters [L3].

2307326L.CO.4: Distinguish among the different placement and routing algorithms [L3].

**COURSE ABSTRACT:**

This course provides the knowledge of CMOS technology and fabrication aspects in VLSI. Furthermore, emphasizes on practical and theoretical aspects related to modern semiconductor engineering. The curriculum covers the complete fabrication process, focusing on design rules, power distribution techniques, and layout constraints. Advanced topics includes sign off is also covered in the course. Moreover, it highlights design for testability, covering various testing techniques and fault models, preparing students for real-world challenges in VLSI design and testing. The practical aspect of the subject covers the exploration of the various CAD tools

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **CMOS Inverter** | **4 HOURS** |
| Design the stick diagram representation of CMOS inverter, draw the layout and check the functionality To prepare CMOS layout use selected technology, simulate with and without capacitive load, comment on rise, and fall times | | |
| **PRACTICAL NO.02** | **NAND/NOR gate** | **4 HOURS** |
| Design the stick diagram representation of NAND/NOR gate, draw the layout and check the functionality<br>Specify the used technology node | | |
| **PRACTICAL NO.03** | **Half Adder and Full Adder** | **4 HOURS** |
| Prepare layout for Half Adder & Full Adder with and without capacitive load<br>Specify the used technology node | | |
| **PRACTICAL NO.04** | **Multiplexer** | **4 HOURS** |
| Prepare the layout of Mux using logic gates & transmission gates<br>Specify the used technology node | | |
| **PRACTICAL NO.05** | **CMOS SPICE Simulation** | **4 HOURS** |
| Model the CMOS inverter circuit with SPICE<br>Perform DC and transfer analysis | | |
| **PRACTICAL NO.06** | **Combinational Design SPICE Simulation** | **2 HOURS** |
| Model the given CMOS combinational logic circuit with SPICE<br>Perform DC and transfer analysis | | |
| **PRACTICAL NO.07** | **Sequential Design SPICE Simulation** | **2 HOURS** |
| Sequential Circuit Design using D /JK Flipflops in SPICE | | |
| **PRACTICAL NO.08** | **Placement and Routing** | **2 HOURS** |
| Study and analyze the Power plan/floorplan/routing algorithms | | |

## TEXT BOOKS


1. Silberschatz, A., Korth, H., Sudarshan, S. (2019). *Database System Concepts*. 7th Edition, McGraw Hill Publishers. ISBN 9780078022159.
2. Elmasri, R., Navathe, S. (2017). *Fundamentals of Database Systems*. 7th Edition, Pearson Education. ISBN 9789332582705.


## REFERENCE BOOKS


1. Coronel, C., Steven Morris. (2018). *Database Systems: Design, Implementation & Management*. 13th Edition, Course Technology. ISBN 1337627909.
2. Date, C. (2002). *An Introduction to Database Systems*. 7th Edition, Pearson Education. ISBN 81 -7808-23.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | RTOS on ARM Processor Lab |
| | **COURSE CODE** | 2307364L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307364L.CEO.1: To interpret RTOS practically using FreeRTOS and ARM Cortex M MCUs.
2307364L.CEO.2: To clarify the complete Architecture (ARM Cortex M) related code of FreeRTOS.
2307364L.CEO.3: To illustrate the RTOS task creation & scheduling algorithms.
2307364L.CEO.4: To Debug FreeRTOS with available software.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307364L.CO.1: Demonstrate RTOS practically using FreeRTOS and ARM Cortex M MCUs [L3].
2307364L.CO.2: Utilize the complete Architecture (ARM Cortex M) related code of FreeRTOS [L3].
2307364L.CO.3: Execute the RTOS task creation & scheduling algorithms [L3].
2307364L.CO.4: Implement the real world problems using RTOS [L6].

**COURSE ABSTRACT:**

FreeRTOS is ideally suited to deeply embedded real-time applications that use microcontrollers or small microprocessors. This type of application normally includes a mix of both hard and soft real-time requirements.FreeRTOS is a real-time kernel (or real-time scheduler) on top of which embedded applications can be built to meet their hard real-time requirements. It allows applications to be organized as a collection of independent threads of execution. On a processor that has only one core, only a single thread can be executing at any one time. The kernel decides which thread should be executing by examining the priority assigned to each thread by the application designer.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Introduction to FreeRTOS** | **2 HOURS** |
| Real Time Application(RTAs) , Real Time Operating System(RTOS), RTOS vs GPOS : Task Scheduling, RTOS vs GPOS : Latency, Priority Inversion, Multitasking | | |
| **PRACTICAL NO.02** | **IDE Installation and Development Board** | **2 HOURS** |
| About the IDE, IDE installation(Windows), Development board used for the course | | |
| **PRACTICAL NO.03** | **Creating FreeRTOS based Project on ARM Cortex M MCUs** | **2 HOURS** |
| Creating new ARM Cortex M MCU project, Adding FreeRTOS kernel source to project, Include path settings, FreeRTOS Config.h and other settings, Time base selection for ARM Cortex M +FreeRTOS project. | | |
| **PRACTICAL NO.04** | **FreeRTOS Task Creation** | **2 HOURS** |
| What is task ?, FreeRTOS task creation API, Task priorities in FreeRTOS<br>Application : Lift management System<br>Design and Develop code to create the multiple tasks for a given application | | |
| **PRACTICAL NO.05** | **IDLE Task and Timer Services Task of FreeRTOS** | **2 HOURS** |
| Implementation Multitasking using of IDLE Task and Timer for Lift management system. | | |
| **PRACTICAL NO.06** | **FreeRTOS Scheduler** | **2 HOURS** |
| FreeRTOS scheduler, Understanding implementation of xPortStartScheduler( ) of port.c Implementation of Scheduler to handle the tasks created for lift Management System | | |
| **PRACTICAL NO.07** | **FreeRTOS and ARM Cortex Mx Architecture** | **2 HOURS** |
| FreeRTOS Kernel interrupts, RTOS Tick and SysTick Timer explanation, Configuration of the RTOS Tick Timer, RTOS Tick ISR (SysTick ISR)<br>Implementation task creation , Deletion, Scheduling on multiple task for Lift Management System | | |

## TEXT BOOKS


1. Rajib Mall (2007). *Real-Time Systems: Theory and Practice*. 2nd Edition, Pearson Education. ISBN: 9788131700693.
2. Brian Amos (2020). *Hands-On RTOS with Microcontrollers: Building real-time embedded systems using FreeRTOS, STM32 MCUs, and SEGGER debug tools*. 1st Edition, Packt Publishing. ISBN13 978-1838826734.


## REFERENCE BOOKS


1. Jean J.Labrosse (2018). *MicroC OS II, The Real-Time Kernel*. 2nd Edition, CMP Books. ISBN 0879304448 .
2. Frank Vahid and Tony Givargis (2002). *Embedded System Design A Unified hardware/ Software introduction*. 3rd Edition, Wiley Publication. ISBN 0471386782 .
3. Richard Barry . *Mastering the FreeRTOS Real Time Kernel, A Hands-On Tutorial Guide*.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Computer Networks Lab |
| | **COURSE CODE** | 2307365L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307365L.CEO.1: To acquaint the students with taxonomy and terminology of the computer Networking area.

2307365L.CEO.2: To acquire the required skill to design simple computer network/s.

2307365L.CEO.3: To classify the computer networks according to IP address classes.

2307365L.CEO.4: To introduce the student to advanced networking concepts.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307365L.CO.1: Distinguish various modern simulation tools and network devices to implement efficient computer network [L4].

2307365L.CO.2: Build the network for real life application using various addressing mode and communication protocols [L6].

2307365L.CO.3: Analyze the performance of the network [L4].

2307365L.CO.4: Distinguish among the network based on address classification [L3].

2307365L.CO.5: Categorize routing protocols for different real time scenarios [L4].

**COURSE ABSTRACT:**

A computer network is a set of computers connected for the purpose of sharing resources. The most common resource shared today is connection to the Internet. Other shared resources can include a printer or a file server. This course deals with fundamentals of computer network. It deals with various network models, types and OSI layers. This course provides uses of computer network, role of seven OSI layers for wire oriented and wireless communication. At the end of the course, the students will be able to build an understanding of the fundamental concepts of computer networks, networking concepts, network layers, network standards protocols, fundamental network security etc.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Network Commands** | **2 HOURS** |
| Basic network commands and Network configuration commands. | | |
| **PRACTICAL NO.02** | **Network Topologies** | **2 HOURS** |
| Design and test the Different network topologies using Cisco Packet tracer. | | |
| **PRACTICAL NO.03** | **Cable Configurations** | **2 HOURS** |
| Make an ethernet Crossover/Straight Through/Rollover cable configurations using UTP-CAT5 cables. | | |
| **PRACTICAL NO.04** | **Device Configurations** | **2 HOURS** |
| Configuration of a. Switch, b. Router using Cisco Packet tracer. | | |
| **PRACTICAL NO.05** | **Web Server Configuration** | **2 HOURS** |
| Configuration of Web Server and hosting web page using Cisco packet tracer. | | |
| **PRACTICAL NO.06** | **Configuration of Application layer protocols** | **2 HOURS** |
| Configure network using Application layer protocols (DNS/DHCP) Cisco packet tracer. | | |
| **PRACTICAL NO.07** | **TELNET Configuration** | **2 HOURS** |
| Configuration of TELNET using Cisco packet tracer. | | |
| **PRACTICAL NO.08** | **DVRP Configuration** | **2 HOURS** |
| Configure network using Distance Vector Routing Protocol using Cisco packet tracer. | | |
| **PRACTICAL NO.09** | **LSRP Configuration** | **2 HOURS** |
| Configure network to implement Link State Routing using Cisco packet tracer. | | |
| **PRACTICAL NO.10** | **Laboratory Project, Group Activity and Demonstration** | **4 HOURS** |
| A group activity to build the mini project for any real-life application, using modern simulation tool / hardware implementation to illustrate computer network concepts. Demonstration of Laboratory project implemented on any one of the following topics:<br>1. Configuration of basic router/switch. 2. Setup an email server. 3. Design a LAN Tester/ cable Tester 4. Comparison of Wireshark/TCPDUMP/ETHEREAL. | | |

| PRACTICAL NO.11 | Laboratory Project, Group Activity and Demonstration | 4 HOURS |
|---|---|---|

A group activity to build the mini project for any real-life application, using modern simulation tool / hardware implementation to illustrate computer network concepts. Demonstration of Laboratory project implemented on any one of the following topics:

5. IP Addressing 6. ARQ techniques 7. Demonstration on computer networks online tools/games/animations 8. Congestion Control techniques .

| PRACTICAL NO.12 | Laboratory Project, Group Activity and Demonstration | 4 HOURS |
|---|---|---|

A group activity to build the mini project for any real-life application, using modern simulation tool / hardware implementation to illustrate computer network concepts. Demonstration of Laboratory project implemented on any one of the following topics:

9. Subnet Calculator 10. Network Performance Analyzer 11. IP Address Converter from Decimal to Binary & Binary to Decimal 12. Case study Blog writing / Poster preparation / Technical report writing on Various communication networks of industries like MITAOE, TATA communication, BSNL, Radio communication, Mobile communication by JIO etc.

## TEXT BOOKS


1. Behrouz A. Forouzan, (2022) Data Communications and Networking, 6th edition, Tata McGraw-Hill Publications, 2013.
2. Andrew Tanenbaum, Computer Networks, 4th Edition, Pearson Education.ISBN-9780130661029.
3. Kurose & Ross, Computer Networking: A Top-Down Approach featuring the Internet. 3rd edition, Pearson Education, ISBN-9788131790540.


## REFERENCE BOOKS


1. Andrew S. Tanenbaum, David J. Wetherall, (2022) Computer Networks, 5thedition, Pearson Education India, ISBN 978-9332518742.
2. Larry L. Peterson Bruce S. Davie, (2011) Computer Networks, 4th edition, Morgan Kaufmann Publisher, ISBN 978-0-12-370548-8.
3. William Stallings, (2020) Data and Computer Communications, 9thedition, Pearson Education India, 2013, ISBN 978-9332518865.
4. Doulas E. Comer, (2016) Computer Networks and Internets, 6th edition, Pearson Education Limited, ISBN 978-1292061177.
5. Siva Ram Murthy, (2017) Ad-HoC Wireless Networks, Pearson Publication

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Model Based Design (MBD) Lab |
| | **COURSE CODE** | 2307366L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2307366L.CEO.1: To learn about the lifecycle and workflow in Model-Based Design, from requirements to deployment.

2307366L.CEO.2: To understand the importance of clear and precise requirements in the modeling process.

2307366L.CEO.3: To understand about automatic code generation from models and its advantages.

2307366L.CEO.4: To learn Hardware-in-the-Loop (HIL) and Software-in-the-Loop (SIL) testing to validate models in real-world scenarios.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307366L.CO.1: Demonstrate proficiency in using industry-standard MBD tools, such as MATLAB/Simulink, for creating and managing models [L2].

2307366L.CO.2: Develop accurate and detailed models that represent system requirements and specifications [L3].

2307366L.CO.3: Conduct thorough simulations to analyze and verify the behavior and performance of models [L4].

2307366L.CO.4: Create comprehensive test plans and perform rigorous validation of models using techniques such as Hardware-in-the-Loop (HIL) and Software-in-the-Loop (SIL) testing [L6].

**COURSE ABSTRACT:**

Model-based development (MBD) is an innovative approach to designing complex systems, such as software applications, control systems, and embedded systems. This methodology involves using models to represent different aspects of the system, such as its behavior, functionality, and structure. By creating and manipulating these models, developers can design, and simulate the system in a controlled and efficient manner. In this course, students will gain a deep understanding of the fundamentals of MBD and develop the skills necessary to succeed in this exciting field. They will start by learning the basic concepts and principles that underlie MBD, including the different types of models and their applications. Students will also explore the various tools and techniques used in MBD, such as implementation and simulation.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Fundamentals & Basics of MATLAB scripting** | **4 HOURS** |

- Introduction to MATLAB scripting and Syntax Basics
- Vectors, Matrices & Data Types in m-scripting
- MATLAB Operators, Decision Making Statements & Strings in m-scripting
- MATLAB Data Structures Overview & Cell Arrays in m-scripting
- Tables & Structures, MATLAB Functions & Callbacks in m-scripting
- File Handling Formats, Debugging & Flow Control Logics in m-scripting
- Block properties, Different Workspaces in m-scripting
- Programmatically accessing Simulink in m-scripting

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Simulink** | **4 HOURS** |

- Introduction to Simulink & Simulink Toolbars
- Block Settings, Model Annotation, Simulink Solvers
- Sources & Sink Libraries
- Math Operations; Logical & Bit Operations
- Ports & Subsystems; Atomic Subsystems
- Masked Subsystem & Linked Libraries
- Continuous, Discontinuous & Discrete Blocks
- User-Defined Functions & Lookup Tables
- Stateflow

| PRACTICAL NO.03 | MATLAB Model-Based Development | 6 HOURS |
|---|---|---|

- Overview of Automotive Industry
- Software Development demands of Automotive Industry
- Model Based Development in Automotive Industry & Model Based Development in MATLAB
- Requirement Analysis in Model Based Development
- Model Based Development Configuration Parameters Settings
- Creating Simulink Data Dictionary
- Accessing Simulink Data Dictionary & Port Property Settings Signal Names & Signal Property Configuration

| PRACTICAL NO.04 | Model Validation | 8 HOURS |
|---|---|---|

- Model Simulation & Model Advisor Report
- Code Generation Settings, Auto-code Generation
- Overview of Model in Loop, Software in Loop & Hardware in Loop
- Testing Theory
- Test Report Analysis (Coverage Analysis & Different Techniques)
- Model in Loop Testing
- Software in Loop Testing
- Overview of Hardware in Loop Testing

| PRACTICAL NO.05 | Processor In The Loop Real-Time Simulations | 6 HOURS |
|---|---|---|

- Controller on Hardware Target
- Plant on Real-Time Target
- Display Performance on Virtual Gauge Display
- Data Collection of Performance

## TEXT BOOKS


1. Priyanka Patankar and Swapnil Kulkarni. (2022). *MATLAB and Simulink In-Depth: Model-based Design with Simulink and Stateflow, User Interface, Scripting, Simulation, Visualization and Debugging*. 1st Edition, BPB Publications. ISBN 978-9355511997 .
2. Roger Aarenstrup. (2015). *Managing Model-Based Design*. 1st Edition, The MathWorks, Inc. ISBN 978-1512036138.


## REFERENCE BOOKS


1. (2020). *Control Algorithm Modeling Guidelines Using MATLAB, Simulink, and Stateflow*. 5th Edition, MathWorks Advisory Board (MAB).
2. Gabriela Nicolescu and Pieter J. Mosterman. (2017). *Model-Based Design for Embedded Systems* . 1st Edition, CRC Press. ISBN 978-1138114722 .

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Network Security |
| | **COURSE CODE** | 2306332T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2306332T.CEO.1: To grasp fundamental principles of network security and the significance of securing network infrastructures.

2306332T.CEO.2: To understand Design and deployment of Virtual Private Networks (VPNs) for secure remote access.

2306332T.CEO.3: To analyze common network protocols and identify their security weaknesses.

2306332T.CEO.4: To implement encryption and decryption methods to protect data integrity and confidentiality.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2306332T.CO.1: Understand and apply core concepts of network security [L2].

2306332T.CO.2: Utilize cryptographic techniques to protect data integrity and confidentiality [L3].

2306332T.CO.3: Use network security tools to perform monitoring, analysis, and penetration testing [L4].

2306332T.CO.4: Stay informed about current trends and emerging threats in the field of network security [L4].

**COURSE ABSTRACT:**

The Network Security course provides a comprehensive overview of the principles, practices, and technologies used to protect information and systems from cyber threats. This course covers essential topics such as cryptography, network protocols, threat analysis, security policies, and defensive strategies. Through a combination of theoretical knowledge and hands-on practice, students will gain the skills necessary to secure networks and mitigate security risks in various environments.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Networking Security** | **04 HOURS** |

**Applications/Case Study:** Network designing

**Contents:** Concept of Network Security, Comparison of TCP IP & OSI model, Need of Network security, Introduction to layer security protocols.

**Further Readings/Self Study:** Computer Networking concepts

| | | |
|---|---|---|
| **UNIT 2** | **Authentication and Security** | **06 HOURS** |

**Applications/Case Study:** Sony PlayStation Network Hack (2011)

**Contents:** Security attacks, Services and Mechanism, A model for network security, Integrity check, Digital Signature, authorization and Authentication

**Further Readings/Self Study:** LinkedIn Login for Professional Services

| | | |
|---|---|---|
| **UNIT 3** | **Networking Protocols** | **06 HOURS** |

**Applications/Case Study:** Web Browsing

**Contents:** Routing Algorithm: Distance Vector Routing Algorithm, Link State Routing, RPL, TCP, UDP, HTTP / HTTPS

**Further Readings/Self Study:** Authentication Applications: Kerberos

| | | |
|---|---|---|
| **UNIT 4** | **Security Algorithms** | **08 HOURS** |

**Applications/Case Study:** Windows Active Directory

**Contents:** Public key Cryptography: Algorithms, examples, Modular arithmetic (addition, multiplication, inverse, and exponentiation) RSA: generating keys, encryption and decryption. Other Algorithms: PKCS, Diffie-Hellman, El-Gamal signatures, DSS, Zero-knowledge signatures. Attacks in WSN

**Further Readings/Self Study:** Transactions on e-commerce websites.

| | | |
|---|---|---|
| **UNIT 5** | **IP Security** | **06 HOURS** |

**Applications/Case Study:** Securing Online Payments

**Contents:** IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management, Web Security: Web Security Considerations, Secure Socket Layer and Transport Layer, Security, Secure Electronic Transaction, Firewall.

**Further Readings/Self Study:** Protecting Financial Data

## TEXT BOOKS


1. William Stallings (2018). *Network Security Essentials*.. 6th Edition, Pearson Education . ISBN 978-9352866601.
2. Chris Sanders, Jason Smith. (2013). *Applied Network Security Monitoring: Collection, Detection, and Analysis*. 2nd Edition, Elsevier. ISBN 9780124172166.


## REFERENCE BOOKS


1. Raef Meeuwisse (2017). *Cybersecurity for Beginners*.. 2nd Edition, Cyber Simplicity Limited Publications. ISBN 9781482233896.
2. Patrick Engebretson (2017). *The Basics of Hacking and Penetration Testing*. 2nd Edition, Syngress. ISBN 978-0124116443.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2028 - 2029 (Rev. 2023 (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Network Security Lab |
| | COURSE CODE | 2306332L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2306332L.CEO.1: To understand the network security principles, including confidentiality, integrity, and availability..

2306332L.CEO.2: To Understand and apply cryptographic techniques to protect data in transit and at rest..

2306332L.CEO.3: To Develop skills to monitor and analyze network traffic for anomalies and potential security breaches.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2306332L.CO.1: implement and manage various network security measures effectively [L4]

2306332L.CO.2: analyze and resolve network security issues using systematic approaches [L5].

2306332L.CO.3: Understand the importance of ethical behavior and professional responsibilities in network security [L5].

**COURSE ABSTRACT:**

The Network Security course provides a comprehensive overview of the principles, practices, and technologies used to protect information and systems from cyber threats. This course covers essential topics such as cryptography, network protocols, threat analysis, security policies, and defensive strategies. Through a combination of theoretical knowledge and hands-on practice, students will gain the skills necessary to secure networks and mitigate security risks in various environments.

**PRACTICALS**

| **PRACTICAL LIST** | **Implement any seven experiment successfully** | **7 HOURS** |
|---|---|---|

Deploy an IoT based automation system for controlling various appliances such as fan, lights, water pumps etc.

1. Design a Virtual Private Network using switch and establish a communication with different terminals
2. Design a Virtual Private Network using Router and establish a communication with different terminals.
3. Configure network using Distance Vector Routing Protocol.
4. Configure network using Link State vector routing protocol.
5. Write and execute a program to implement Data Encryption Standard (DES)
6. Write and execute a program to implement RSA algorithm
7. Write and execute a program to implement Diffle-Hellman key exchange algorithm
8. Installation and configuration of Web Server and hosting web page using HTML programming

| **CASE STUDY** | **Implement any one case study successfully** | **3 HOURS** |
|---|---|---|

1. Protecting the transmission of sensitive patient data between healthcare providers, insurance companies, and pharmacies.
2. Secure communication between bank branches and data centers, protecting sensitive transactions and customer information.
3. Protecting sensitive payment information and personal data during online transactions on e-commerce platforms.
4. Uploading and downloading files from web servers or between systems, such as using FileZilla or transmitting website data.

## TEXT BOOKS


1. William Stallings (2018). *Network Security Essentials*.. 6th Edition, Pearson Education . ISBN 978-9352866601.
2. Chris Sanders, Jason Smith. (2013). *Applied Network Security Monitoring: Collection, Detection, and Analysis*. 2nd Edition, Elsevier. ISBN 9780124172166.


## REFERENCE BOOKS


1. Raef Meeuwisse (2017). *Cybersecurity for Beginners*.. 2nd Edition, Cyber Simplicity Limited Publications. ISBN 9781482233896.
2. Patrick Engebretson (2017). *The Basics of Hacking and Penetration Testing*. 2nd Edition, Syngress. ISBN 978-0124116443.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES** | **W.E.F** | **AY:** 2028 - 2029 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Employability and Career Development |
| | **COURSE CODE** | 2301371L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PRE-REQUISITE KNOWLEDGE :** Communication Skills, Universal Human Values-II.

**COURSE OBJECTIVES :**

2301371L.CEO.1: To define the importance of Employability skills in students life.
2301371L.CEO.2: To explain them necessary, specific Employability Career Development skills.
2301371L.CEO.3: To appraise students for placements through acquisition of professional skills.
2301371L.CEO.4: To support them detect their present level in respect of each Career Development skill and show direction for improvement..

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301371L.CO.1: Relate the importance of Employability Career Development [L2].
2301371L.CO.2: Build necessary, specific professional skills [L3].
2301371L.CO.3: Analyze the environment of employability [L4].
2301371L.CO.4: Develop various techniques of effective team building in their professional life [L6].

**COURSE ABSTRACT:**

The Employability and Career Development course is designed to enhance students' career readiness and personal growth through practical exercises focused on key aspects of professional development. The course covers self-management skills such as time management and goal setting, essential for personal productivity. Students will engage in personal interviews and group discussions to strengthen their communication abilities and public speaking confidence. Team building and motivational practices are explored to foster collaboration and a positive work environment. Innovative thinking is emphasized to cultivate creativity and adaptability in problem-solving. Additionally, students will learn profile development strategies, including crafting impactful resumes and LinkedIn profiles to enhance their professional online presence. By incorporating aptitude training and a focus on employability, the course aims to equip students with the necessary skills and mindset for success in their careers.

**SECTION A: Personal Development with the help of Professionals (25 Marks)**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Self Management** | **4 HOURS** |

Concept of Johari Window,Advantages and disadvantages of every quadrant,Identifying the proportion of each quadrant in respect of self, Using the tools of self-evaluation, self-development and Goal Setting, Stress management, Career anchor.

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Personal Interviews** | **4 HOURS** |

Preparing for Interviews, Typical expected questions suggested responses, Posture, Body language, Greetings and pleasantries, , Handling unforeseen questions.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Group Discussion and Public Speaking** | **4 HOURS** |

Parameters of assessment,Initiating the discussion,Effective listening,Own contribution,Paraphrasing,Arguing and counter-arguing, Giving direction to the discussion, Public Speaking skills.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Team Building and Motivation** | **4 HOURS** |

Hallmark of effective teams, Barriers to teamwork, Subjugation of Individual interests for achievement of teams goal, Leading motivating team members.

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **Innovative Thinking** | **4 HOURS** |

Relevance and importance of innovative thinking, Introduction to Brain Storming technique,Collective and individual Brain Storming.

| | | |
|---|---|---|
| **PRACTICAL NO.06** | **Profile Development** | **6 HOURS** |

Resume Writing: Introduction to the Resume, Key Components of a Resume and Cover Letter, Enhancing tips for Resume and Cover Letter.

Letter of recommendation (LOR) preparation: Details on types, samples, structure, content tips format for letters of recommendation for student.

Statement of Purpose (SOP) preparation: SOP Formats, Templates, and Guidelines for SOP Writing.

Job application and professional email writing.

| SECTION B: | Aptitude Training from Video Based Content and Assessment Platform. (25 Marks) | 30 HOURS |
|---|---|---|

1. Number System
2. HCF LCM , Surds and Indices.
3. Percentages and Average.
4. Time and work.
5. Time, Speed and Distance.
6. Probability.
7. Quadratic Equations.
8. Profit and Loss.
9. Simple and Compound Interest.
10. Ratio and proportion.
11. Permutation and Combination.
12. Boats and Streams, Pipes and Cisterns.
13. Mixtures and Allegations, Mensuration.
14. Data Interpretation Tables, Pie Charts, Bar Graphs, Line Graphs.

| SECTION C: | Final Assessment with the help of career Assessment Test (25 marks) | 2 HOURS |
|---|---|---|

**TEXT BOOK**


1. J.K.Gangal, A Practical Course in Effective English Speaking Skills, Prentice Hall India Learning Private Limited (2012), ISBN-10: 8120345843.
2. Jean Yates, Practice Makes Perfect: English Conversation, Premium Second Edition, McGraw-Hill Education; 2 edition, ISBN-10: 1259643271.
3. R S Agrawal, Quantitative Aptitude, S. Chand Publishing (2020), ISBN: 9789352534029, 9789352534029.
4. Shakuntala Devi, Puzzles to Puzzle You, Orient Paperbacks, ISBN: 9788122200140, 9788122200140.


**REFERENCE BOOK**


1. Stephen Covey: The Seven Habits of Highly Effective People, Simon and Schuster Ltd, ISBN: 0-671-71117-
2. Krishna Mohan, Meera Banerji, Developing Communication Skills, Birla Institute of Technology and Science, ISBN: 033392-919-5.
3. Charles Kepner and Benjamin Tregoe, The Rational Manager: A systematic Approach to Problem Solving and Decision Making , Tata McGraw-Hill Publishing Company Ltd., ISBN:13:978-0070341753.
4. Priyadarshini Patnaik, Group Discussion and Interview Skills , Foundation Books, 1st Ed.- 2011, ISBN No.: 9788175967847, 8175967846.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2028 - 2029 (Rev. 2023 (NEP)) |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Major Project - II |
| | COURSE CODE | 2307392L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : -- | REVISION NO. | 2.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307392L.CEO.1: To equip students with the knowledge and skills necessary to design innovative engineering solutions for complex technical problems.

2307392L.CEO.2: To train students in the practical implementation of engineering designs, ensuring they can bring theoretical concepts to life using modern tools and techniques.

2307392L.CEO.3: To understand how to create detailed project plans that encompass all stages of implementation, from initial concept to final product.

2307392L.CEO.4: To foster students ability to critically evaluate and iterate on their implementations, incorporating feedback and testing results to optimize performance and effectiveness.

2307392L.CEO.5: To enhance students communication skills, enabling them to effectively present their implementation processes and outcomes to diverse audiences.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307392L.CO.1: Demonstrate proficiency in implementing engineering designs, utilizing modern tools, techniques, and technologies to bring their solutions to fruition [L4].

2307392L.CO.2: Conduct rigorous testing and evaluation of implemented solutions, analyzing performance data to ensure that the solutions meet specified requirements and quality standards [L5].

2307392L.CO.3: Incorporate ethical considerations and sustainable practices into their implementation processes, evaluating the societal and environmental impacts of their solutions [L3].

2307392L.CO.4: Work effectively in multidisciplinary teams, demonstrating strong collaboration, leadership, and project management skills throughout the implementation phases [L3].

## COURSE ABSTRACT:

The project is most important part of undergraduate curriculum and enables students to develop analytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Project Design, Project Implementation and Project Evaluation. After successful completion of project design phase in Sem V (project design), next step is project implementation (Sem VI). The goal of this phase of the project is to implement/develop/experiment/simulate/test the techniques/processes of the project and give a mature shape. The implementation can be a combination of algorithms, techniques, processes, testing etc. This will also include drawing inferences from the results and discussing them.

## GUIDELINES

1. Preferably project group students of Sem V would be continued in this semester VI.
2. Every project group should consist of minimum 03 and maximum of 04 students.
3. The group members may be from different programs to support the interdisciplinary functioning.
4. Project group members and title of the project need to be approved by Project Guide and School.
5. Projects should preferably have a national/international, industry/academic/research collaboration.
6. User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
7. The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.
8. Define proposed solution and apply project management/modeling tools for project planning and design.
9. Define outcome, milestones, definite roadmap for project design, implementation, tools, resources, performance evaluation and documentation.
10. Perform refinement of System architecture & methodology.
11. Students should give a mature shape to their idea in terms of implementation. This is expected in this semester. This may include one or many of these points. Implementation /development/experimentation/simulation/testing/building the techniques/processes

**Collaborative/Sponsored Project**

1. Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for project work.
2. Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization at the start of semester VI.
3. Proposed Collaborative Project work need to be reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of 12 months.
4. Final assessment will be carried out in presence of faculty mentor, external mentor and examiner.

**TIMELINE**

1. Freezing of project groups and titles. Refinement of title and objectives from Sem V should freezed by the time of first review.
2. Final Synopsis of the project. (To be done at guide level)
3. Methodology / System Design / Block Diagram should be properly explained by the student
4. Project Review I Presentation.
5. Project Implementation: Students should take the work in one and/more of the points. Like Implementation/development/experimentation/simulation/testing/experimental yield/building the techniques/processes etc
6. Based on the points discussed in 5, student would be able to get results and discuss them. Students should be able to draw inferences from results.
7. Project Review II Presentation.
8. Quality of Publication and Researchers: Students would be educated on different technical papers and their importance (article types, journal metrics etc) along with author/researcher credentials.
9. Project Documentation: Project Report Writing

## ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Project Review I: Problem Statement and objectives, Implementation plan & action (algorithms/techniques/models/mathematical understanding/implementation) (10 Marks)
2. An activity on illustrating methodology. This may inlcude paper reading activity: Read and Summarize a paper in 1 page (Individual to every student of the group). Any other activity can also be taken take would illustrate methodology (10 marks)
3. Project Review II: Results and Implementation, Observations, Inferences, Discussion on algorithms / techniques /models / testing) (10 Marks)
4. Article Quality and Author Credentials: Information about Research Article types, paper quality metrics (SCI/SCOPUS/WOS) and Author Credentials (Citation count, h-index, I10 index etc) (5 marks)
5. Project Report (10 Marks)
6. Project: Documentation Final Presentation and Demonstration (30 Marks)

(Parameters of evaluation: Final implemented work, report, presentation and paper drafted based on work)

## TEXT BOOKS


1. John M. Nicholas. (2012). *Project Management for Engineering, Business and Technology*. 4th Edition, Butterworth-Heinemann. ISBN 978-0080967042.
2. Leslie Lamport. (1994). LaTeX: *A document preparation system, Users guide and reference manual*. 2nd Edition, Addison-Wesley. ISBN 978-0201529838.


## REFERENCE BOOKS


1. Michelle Reid. (2018). *Report Writing (Pocket Study Skills)*. 2nd Edition, Bloomsbury Publishing. ISBN 978-0230376557.
2. Sara Efrat Efron and Ruth David. (2018). *Writing the Literature Review : A Practical Guide*. 1st Edition, Guilford Press . ISBN 978-1462536894 .

MIT | Academy of Engineering

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## MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# Final Year

# Bachelor of Technology

# E&TC Engineering

## NEP REVISION 2023 (2.0)

(With Effect from Academic Year: 2029-2030)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2029-2030 |
| FINAL YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

**SEMESTER: VII (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2307411T | Advanced Neural Network Architectures | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 2307421T | Ubiquitous Sensing, Computing and Communication | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2307421L | Ubiquitous Sensing, Computing and Communication Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2307422T | Battery Management Systems for EV | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2307422L | Battery Management Systems for EV Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2307423T | Advance VLSI Design | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2307423L | Advance VLSI Design Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| MDM | *MDM List | Multidisciplinary Minor Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| HSSM MEC | 2307476T | Project Management | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2307491L | Major Project – III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC PRJ | 2307492T | Research Methodology | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC SI | 2307496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| **TOTAL** | | | **13** | **6** | **-** | | | | | | **750** | **20** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2029-2030 |
| FINAL YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

**SEMESTER: VIII (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2307413T | Wireless Communication | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 230742XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2307SWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| MDM | *MDM List | Multidisciplinary Minor Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2307SWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| OE | 230145XXL | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2307497L | Semester Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 2307498L | Student Outreach Programme | | | | | | | | | | |
| | 2307493L | Capstone Portfolio | | | | | | | | | | |
| TOTAL | | | 10 | 4 | | | | | | | 725 | 20 |

*Credits earned in advance through a credit transfer scheme

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W. E. F | : | 2029-2030 |
| FINAL YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | RELEASE DATE | : | -- |
| | REVISION NO. | : | 2.0 (NEP) |

**SEMESTER: VII (PART B)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2307411T | Advanced Neural Network Architectures | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| MDM | *MDM List | Multidisciplinary Minor Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2307491L | Major Project – III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2307499L | Industry Practicum | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| ELC SI | 2307496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| **TOTAL** | | | **6** | **4** | **-** | | | | | | **750** | **20** |

**SEMESTER: VIII (PART B)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2307413T | Wireless Communication | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 230742XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2307SWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| MDM | *MDM List | Multidisciplinary Minor Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2307SWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| OE | 230145XXL | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2307497L | Semester Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 2307498L | Student Outreach Programme | | | | | | | | | | |
| | 2307493L | Capstone Portfolio | | | | | | | | | | |
| **TOTAL** | | | **10** | **4** | | | | | | | **725** | **20** |

*Credits earned in advance through a credit transfer scheme

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2029 - 2030 (Rev. 2023 (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Advanced Neural Network Architectures |
| | **COURSE CODE** | 2307411T |
| | **COURSE CREDITS** | 4 |
| **RELEASE DATE : --** | **REVISION NO.** | 0.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 4 | NIL | 60 | NIL | 90 | NIL | NIL | 150 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307411T.CEO.1: To introduce the fundamental concepts of neural computation, and essential optimization techniques in deep learning.

2307411T.CEO.2: To develop an understanding of convolutional architectures, and object detection frameworks.

2307411T.CEO.3: To familiarize students to sequence modeling and transformer-based architectures for advanced AI applications.

2307411T.CEO.4: To build competence in transfer learning, foundation models, and generative deep learning techniques.

2307411T.CEO.5: To give awareness on ethical practices through collaborative projects in real-world AI applications.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307411T.CO.1: Analyze the effect of different optimization techniques and neural computation strategies on the performance of deep learning models [L4].

2307411T.CO.2: Implement various CNN architectures and object detection techniques for various applications [L3].

2307411T.CO.3: Analyze sequential and foundation models in real world applications [L4].

2307411T.CO.4: Design end to end deep learning models for domain specific problems using any modern tool [L5].

2307411T.CO.5: Evaluate and present the deep learning model for real time applications [L5].

## COURSE ABSTRACT:

Deep Learning is a foundational course that explores modern neural network architectures and their applications in computer vision, natural language processing, and generative modeling. This course covers from basic neural networks and CNNs to advanced architectures like Transformers, and Large Language Models (LLMs). Key concepts include optimization techniques, regularization, explainability using Grad-CAM, object detection, semantic segmentation, and foundational models such as Autoencoders, GANs, and Diffusion Models.

Students will engage with the course through project based learning (PBL), where real-world applications from domains like image classification, medical image analysis, and natural language problems will be provided. The course emphasizes hands-on learning via case studies. Through this approach, students will not only gain a deep understanding of theoretical concepts but also develop practical skills that enhance their entrepreneurship and employability across diverse fields.

## THEORY COURSE CONTENTS

| UNIT 1 | Fundamentals of Neural Networks and Optimization Techniques | 09 HOURS |
|---|---|---|

**Applications/Case Study:** Image Classification using Feedforward Neural Networks with Optimization Techniques

**Contents:** Neural Computation, Perceptron, Feedforward Neural Network, Gradient Descent Variants: Stochastic GD, Momentum, RMSProp, Adam, AdaGrad, Regularization: (L1, L2), Dropout, Early Stopping, Batch Normalization and Weight Initialization Techniques. Importance of striding, dilation, pooling in CNN.

**Further Readings/Self Study:** Neural Network Initialization Strategies

| UNIT 2 | Advanced CNN Architectures and Explainable Deep Learning | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Image Classification using Pretrained CNN Architectures with Grad-CAM Visualization

**Contents:** Convolutional Neural Networks (CNNs), CNN Architectures: LeNet, AlexNet, VGGNet, Inception-V3, ResNet, MobileNet, Visualizing CNNs, Explainability in DL (Grad-CAM)

**Further Readings/Self Study:** Adversarial Attacks on CNNs and Defences

| UNIT 3 | Object Detection and Segmentation in Deep Learning | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Real-Time Analysis using YOLOv5 and U-Net for Smart Traffic Monitoring

**Contents:** Object Detection: YOLO (v4, v5), Faster R-CNN, Mask R-CNN, Evaluation Metrics for Detection: mAP, IoU Semantic Segmentation: U-Net, DeepLabV3

**Further Readings/Self Study:** Single-stage vs. Two-stage Object Detectors

| UNIT 4 | Sequence Models and Transformer Architectures | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Next-Word Prediction using LSTM and Transformer-based Models

**Contents:** Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTMs), Gated Recurrent Units (GRUs), Transformers: Vision Transformer (ViT), Attention Mechanism: Overview

**Further Readings/Self Study:** Natural Language Processing

| UNIT 5 | Deep Generative Models | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Fine-tuning a Pretrained Model for Classification/Segmentation

**Contents:** Transfer Learning: Concept & Applications, Encoder-Decoder Models: Autoencoders, Denoising Autoencoders GAN, Gen AI, Large Language Models (LLMs): BERT, GPT, LLaMA, Ethical Issues and Bias in Foundation Models

**Further Readings/Self Study:** Few-shot and Zero-shot Learning using Foundation Models

## TEXT BOOKS

There are no specific textbooks for this course. Reference and reading materials will be provided separately. Some general sources that we will use in the course are listed below.


1. Liao, S.C., and Chen, S.H. (2022). *Deep Learning in Medical Image Analysis: Challenges and Applications*. Academic Press, Cambridge, MA, USA. ISBN 978-0128225730.
2. Shortliffe, E.H., and Cimino, J.J. (2021). *Biomedical Informatics: Computer Applications in Health Care and Biomedicine*. 5th Edition, Springer, New York, NY, USA. ISBN 978-3030587205.
3. Chollet, F. (2021). *Deep Learning with Python*. 2nd Edition, Manning Publications, USA. ISBN 978-1617296864.
4. Gron, A. (2019). *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*. 2nd Edition, OReilly Media, USA. ISBN 978-1492032649.
5. Goodfellow, I., Bengio, Y., and Courville, A. (2016). *Deep Learning*. MIT Press, Cambridge, MA, USA. ISBN 978-0262035613.


## REFERENCES

References for this course include curated e-resources and e-content such as educational YouTube channels (DeepLearningAI, StatQuest, Yannic Kilcher), blogs (Towards Data Science, Distill.pub, Analytics Vidhya), and official documentation and tutorials from platforms like TensorFlow, PyTorch, Kaggle, Hugging Face, and Google Colab.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2029 - 2030 (Rev. 2023 (NEP)) |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Ubiquitous Sensing, Computing and Communication |
| | COURSE CODE | 2307421T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : -- | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307421T.CEO.1: To Equip with a comprehensive understanding of the core principles, models, and architectural design strategies of ubiquitous computing systems.

2307421T.CEO.2: To Examine critically a context-aware systems, emphasizing the role of location-based services, social networks, and adaptive architectures in responsive computing environments.

2307421T.CEO.3: To Explore the components and interaction models of smart devices and networks, with attention to both explicit and implicit human-computer interaction techniques.

2307421T.CEO.4: To understand and evaluate how embedded systems, sensor networks, MEMS, and control mechanisms contribute to the creation of intelligent, responsive environments.

2307421T.CEO.5: To Instruct on the key communication infrastructures and protocols that support continuous and integrated access to data, audio, and video across diverse and distributed networks.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307421T.CO.1: Apply the principles, characteristics, and architectural models of ubiquitous computing systems [L3].

2307421T.CO.2: Analyze the role of context-aware computing, communication technologies and protocols used in complex engineering problems of ubiquitous systems [L4].

2307421T.CO.3: Model basic applications that integrate smart devices, sensor networks, and embedded systems [L3].

2307421T.CO.4: Apply human-centered design principles to develop usable interfaces for smart devices [L3].

## COURSE ABSTRACT:

This course explores the fundamental principles and emerging applications of ubiquitous sensing, computing, and communication technologies in modern intelligent environments. Students will develop **critical thinking** and **problem-solving** skills by analyzing real-world scenarios that integrate sensor networks, embedded systems, cloud computing, and wireless communication. Emphasis is placed on **information literacy**, including data acquisition, interpretation, and decision-making in distributed systems. Through collaborative projects and technical writing assignments, students will enhance their **communication** abilities in both oral and written formats. The course also addresses **ethical reasoning** in the design and deployment of pervasive systems, particularly concerning data privacy, security, and societal impact. By the end of the course, students will gain a comprehensive understanding of how ubiquitous technologies are shaping the future of smart environments, from healthcare to smart cities.

## THEORY COURSE CONTENTS

| UNIT 1 | Basics of Ubiquitous Computing | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Smart Home Ecosystem

**Contents:** Examples of Ubiquitous Computing Applications, Holistic Framework for UbiCom: Smart DEI, Modeling the Key Ubiquitous Computing Properties, Ubiquitous System Environment Interaction, Architectural Design for UbiCom Systems: Smart DEI Model, Smart Devices and Services, Service Architecture Models, Service Provision Life Cycle.

**Further Readings/Self Study:** Mobile to enterprise integration

| UNIT 2 | Context-Aware Systems | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Google Assistant Integration with Public Transport Systems

**Contents:** Location in ubiquitous computing: Personal assistants, Location aware computing, Location tracking, Architecture, Location based service and applications, Location based social networks (LBSN), LBSN Recommendation.

Context-aware computing: Context and Context-aware Computing, Issues and Challenges, Developing Context-aware Applications, System Architecture.

**Further Readings/Self Study:** Architectures for scalable LBSNs

| UNIT 3 | Smart Mobiles, Cards and Device Networks | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Mobile affective computing: Human Activity and Emotion Sensing

**Contents:** Smart Mobile Devices, Users, Resources and Code, Operating Systems for Mobile Computers and Communicator Devices, Smart Card Devices, Device Networks.

HumanComputer Interaction (HCI): Explicit HCI, Implicit HCI, User Interfaces and Interaction for Devices, Hidden UI Via Basic Smart Devices, Hidden UI Via Wearable and Implanted Devices, Human Centered Design (HCD).

**Further Readings/Self Study:** Mobile HCI

| UNIT 4 | Smart Environments | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Semantic Web Data Management

**Contents:** Tagging, Sensing and Controlling, Tagging the Physical World, Sensors and Sensor Networks, Micro Actuation and Sensing: MEMS, Embedded Systems and Real Time Systems, Control Systems.

**Further Readings/Self Study:** Real-time and Big Data Analytics for The Internet of Things

| UNIT 5 | Ubiquitous Communication | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Ubiquitous Networking in Smart Healthcare

**Contents: Audio Networks:** PSTN Voice Networks, Intelligent Networks and IP Multimedia Subsystems, ADLS Broadband, Wireless Telecoms Networks, Audio Broadcast (Radio Entertainment) Networks

**Data Networks:** Network Protocol Suites, Addressing, Routing and Internetworking

**Wireless Data Networks:** Types of Wireless Network, WLAN and WiMAX, Bluetooth, ZigBee, Infrared, UWB, Satellite and Microwave Communication, Roaming between Local Wireless LANs

**Universal and Transparent Audio, Video and Alphanumeric Data Network Access:** Combined Voice and Data Networks, Combined Audio Video and Data Content Distribution Networks, On demand, Interactive and Distributed Content

**Ubiquitous Networks:** Wireless Networks, Power Line Communication (PLC), Personal Area Networks, Body Area Networks, Mobile Users Networks

**Network Design Issues**

**Further Readings/Self Study:** Scalable and Secure Wireless Ubiquitous Networks for Real-Time Multimedia Applications

## REFERENCE BOOKS


1. John Krumm. (2009). *Ubiquitous Computing Fundamentals*. 1st Edition, CRC Press. ISBN 978-1420093605.
2. N. Jeyanthi, Ajith Abraham, Hamid Mcheick. (2019). *Ubiquitous Computing and Computing Security of IoT*. 1st Edition, Springer Cham. ISBN 978-3-030-01565-7.
3. Dr. Jeeva Jose. (2018). *Internet of Things*. 1st Edition, Khanna Publishing House. ISBN 978-9386173591.
4. Stefan Poslad. (2009). *Ubiquitous Computing Smart Devices, Environments and Interactions*. Wiley. ISBN 978-0-470-03560-3.

## E-RESOURCES

1. Introduction to the Internet of Things and Embedded Systems
   https://www.coursera.org/learn/iot
2. Introduction to Cloud Computing
   https://www.coursera.org/learn/introduction-to-cloud
3. Emerging Technologies: From Smartphones to IoT to Big Data Specialization on Coursera

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2029 - 2030 (Rev. 2023 (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Ubiquitous Sensing, Computing and Communication Lab |
| | **COURSE CODE** | 2307421L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 0.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307421L.CEO.1: To equip with the skills to design and implement systems using sensors, microcontrollers, and communication modules.

2307421L.CEO.2: To utilize cloud services efficiently for data management, processing, and analytics in projects.

2307421L.CEO.3: To provide hands-on experience with sensor interfacing, and communication protocols.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307421L.CO.1: Analyze real-time sensor data using plots and dashboards [L4].

2307421L.CO.2: Design an end-to-end IoT solution integrating sensors, mobile apps, cloud platforms, and MQTT communication protocols [L6].

2307421L.CO.3: Inspect the real time case scenarios from different domains in a team and make an effective presentation [L4].

## COURSE ABSTRACT:

This course explores the fundamental principles and emerging applications of ubiquitous sensing, computing, and communication technologies in modern intelligent environments. Students will develop **critical thinking** and **problem-solving** skills by analyzing real-world scenarios that integrate sensor networks, embedded systems, cloud computing, and wireless communication. Emphasis is placed on **information literacy**, including data acquisition, interpretation, and decision-making in distributed systems. Through collaborative projects and technical writing assignments, students will enhance their **communication** abilities in both oral and written formats. The course also addresses **ethical reasoning** in the design and deployment of pervasive systems, particularly concerning data privacy, security, and societal impact. By the end of the course, students will gain a comprehensive understanding of how ubiquitous technologies are shaping the future of smart environments, from healthcare to smart cities.

## PRACTICALS

| | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Sensor Data Logging & Serial Communication | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Mobile App Development for Sensor Control | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Cloud Connectivity & Real-Time Database | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Publish-subscribe model, Real-time communication between devices using IoT Protocols (MQTT). | | |
| **PRACTICAL NO.05** | | **6 HOURS** |
| Project & Demonstration | | |

## REFERENCE BOOKS

1. N. Jeyanthi, Ajith Abraham, Hamid Mcheick. (2019). *Ubiquitous Computing and Computing Security of IoT*. 1st Edition, Springer Cham. ISBN 978-3-030-01565-7.
2. Dr. Jeeva Jose. (2018). *Internet of Things*. 1st Edition, Khanna Publishing House. ISBN 978-9386173591.
3. Stefan Poslad. (2009). *Ubiquitous Computing Smart Devices, Environments and Interactions*. Wiley. ISBN 978-0-470-03560-3.

## E-RESOURCES

1. MIT App Inventor Tutorials
   https://www.youtube.com/user/MITAppInventor
2. Node-RED Official Guide
   https://nodered.org/docs/
3. Introduction to Cloud Computing
   https://www.coursera.org/learn/introduction-to-cloud

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2029 - 2030 (Rev. 2023(NEP)) |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Battery Management Systems for EV |
| | COURSE CODE | 2307422T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : -- | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307422T.CEO.1: To understand and summarize the basic components and functionality of the Battery Management System.

2307422T.CEO.2: To develop mathematical and equivalent circuit models for analyzing and simulating battery behavior under different operating conditions.

2307422T.CEO.3: To explain the concepts and techniques for state estimation such as State of Charge (SOC), State of Health (SOH), and related parameters.

2307422T.CEO.4: To examine protection, safety, and cell balancing strategies critical to reliable and efficient battery pack operation.

2307422T.CEO.5: To explore real-world BMS applications and case studies in electric vehicles, highlighting current trends and industry practices.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307422T.CO.1: Explain battery concepts, lithium-ion cell types, charging modes, and BMS functions [L2].

2307422T.CO.2: Apply voltage, current, temperature, and isolation sensing techniques for battery pack control and safety [L3].

2307422T.CO.3: Analyze continuous and discrete battery models and identify cell parameters using characterization data [L4].

2307422T.CO.4: Evaluate estimation methods and balancing techniques for optimized battery performance. [L5].

2307422T.CO.5: Design a smart BMS using ML, IoT, and appropriate hardware components [L6].

## COURSE ABSTRACT:

The ”Battery Management Systems” (BMS) course provides a comprehensive introduction to the design, operation, and optimization of battery management technologies used in electric vehicles, renewable energy storage, and portable electronics. Students will learn about battery chemistries, performance parameters, and key BMS functions such as state-of-charge estimation, cell balancing, and safety monitoring. The course covers the architecture of BMS, charging algorithms, communication protocols, and the integration of BMS in real-world applications. Through hands-on projects and simulations, students will develop practical skills to design and analyze battery systems, ensuring efficient operation and longevity in diverse energy applications.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Battery Management System** | **6 HOURS** |

**Contents:** Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging.

| | | |
|---|---|---|
| **UNIT 2** | **Battery Management System Requirement** | **10 HOURS** |

**Contents:** Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, Cell total energy and cell total power, Cell Balancing, Causes of imbalance, Circuits for balancing.

| | | |
|---|---|---|
| **UNIT 3** | **Battery State of Charge and State of Health Estimation** | **8 HOURS** |

**Contents:** Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium-ion aging: Positive electrode.

| UNIT 4 | Modelling and Simulation | 9 HOURS |
|---|---|---|

**Contents:** Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage, Simulating battery packs.

| UNIT 5 | Design principles of BMS | 8 HOURS |
|---|---|---|

**Contents:** Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system.

## TEXT BOOKS


1. G. L. Plett (2015). Battery Modeling: Battery management systems Volume I. Artech House ISBN: 978-1630810245.
2. G. L. Plett (2015). Equivalent-Circuit Methods: Battery Management Systems Volume II. Artech House ISBN: 978-1630810283.


## REFERENCE BOOKS


1. V. Pop, H. J. Bergveld, D. Danilov, P. P. L. Regtien, and H. L. Notten (2008). Battery Management Systems: Accurate State-of-Charge Indication for Battery-Powered Application. Springer, First Edition, ISBN: 978-1-4020-6945-1.
2. D. Andrea (2010). Battery Management Systems for Large Lithium-Ion Battery Packs. Artech House, First Edition, ISBN:978-1608071050.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2029 - 2030 (Rev. 2023 (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Battery Management Systems for EV Lab |
| | **COURSE CODE** | 2307422L |
| | **COURSE CREDITS** | 1 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307422L.CEO.1: To introduce students to the fundamental electrochemical principles governing Li-ion NMC and LFP cells.

2307422L.CEO.2: To develop experimental skills in performing chargedischarge tests and determining discharge capacity under various C-rates.

2307422L.CEO.3: To enable students to compute and interpret key performance parameters such as Coulombic and round-trip efficiencies from measured data.

2307422L.CEO.4: To train students in measuring DC internal resistance (DCIR) and analyzing its effect on cell voltage response and performance.

2307422L.CEO.5: To encourage critical evaluation of experimental results against manufacturer specifications and the identification of deviations due to electrochemical or thermal causes.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307422L.CO.1: Demonstrate the electrochemical characteristics of Li-ion NMC and LFP cells, including OCV, nominal voltage, and discharge behavior under various C-rates [L3].

2307422L.CO.2: Perform chargedischarge experiments to determine the discharge capacity of Li-ion NMC cells at different C-rates under ambient conditions [L3].

2307422L.CO.3: Calculate performance metrics such as Coulombic efficiency and round-trip efficiency of Li-ion NMC cells from experimental data [L3].

2307422L.CO.4: Measure the DC internal resistance (DCIR) of Li-ion NMC and LFP cells using current pulse methods and interpret voltage response [L4].

2307422L.CO.5: Evaluate experimental results against manufacturer specifications to identify deviations and justify electrochemical or thermal causes [L5].

**COURSE ABSTRACT:**

The "Battery Management Systems Lab" course offers hands-on experience in designing, testing, and analyzing battery management systems (BMS) for various applications, including electric vehicles and energy storage. Students will work with real-world battery packs, learning to implement BMS functions such as state-of-charge estimation, cell balancing, and safety protection. The lab focuses on using industry-standard tools for battery modeling, monitoring, and simulation. Through practical projects, students will gain expertise in designing BMS circuits, analyzing battery performance, and troubleshooting common issues. By the end of the course, students will be equipped to develop and optimize BMS solutions for diverse energy systems.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | Measurement of cell nominal voltage by performing open circuit voltage test for NMC cell | **2 HOURS** |
| **PRACTICAL NO.02** | Cell discharge capacity measurement test at standard discharge c-rate for NMC cell | **2 HOURS** |
| **PRACTICAL NO.03** | Cell discharge capacity measurement at 0.5C and 1C discharge c-rates for NMC cell | **2 HOURS** |
| **PRACTICAL NO.04** | Coulombic and Round trip efciency measurement at 0.5c c-rate for NMC cell | **2 HOURS** |
| **PRACTICAL NO.05** | Measurement of cell DC internal resistance by performing DCIR test | **2 HOURS** |
| **PRACTICAL NO.06** | Perform a charge-discharge test to identify the C-Rates while charging and discharging | **2 HOURS** |
| **PRACTICAL NO.07** | Perform a protection test to understand the working of Voltage, current and temperature Protection Logic. | **2 HOURS** |

| | | |
|---|---|---|
| **PRACTICAL NO.08** | Perform a Charge Test and estimate the SoC of the cell through OCV-SOC based SOC Estimation | **2 HOURS** |
| **PRACTICAL NO.09** | Perform a Discharge Test and estimate the SoC of the cell through OCV-SOC + Coulomb Counting based SOC Estimation. | **2 HOURS** |

## TEXT BOOKS


1. G. L. Plett (2015). Battery Modeling: Battery management systems Volume I. Artech House ISBN: 978-1630810245.
2. G. L. Plett (2015). Equivalent-Circuit Methods: Battery Management Systems Volume II. Artech House ISBN: 978-1630810283.


## REFERENCE BOOKS


1. V. Pop, H. J. Bergveld, D. Danilov, P. P. L. Regtien, and H. L. Notten (2008). Battery Management Systems: Accurate State-of-Charge Indication for Battery-Powered Application. Springer, First Edition, ISBN: 978-1-4020-6945-1.
2. D. Andrea (2010). Battery Management Systems for Large Lithium-Ion Battery Packs. Artech House, First Edition, ISBN:978-1608071050.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2029 - 2030 (Rev. 2023(NEP)) |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Advance VLSI Design |
| | COURSE CODE | 2307423T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : -- | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307423T.CEO.1: To correlate ASIC design considerations and timing parameters.
2307423T.CEO.2: To give exposure to the concepts of static timing analysis (STA) and its role in digital design.
2307423T.CEO.3: To familiarize System Verilog language constructs for efficient hardware description and verification.
2307423T.CEO.4: To introduce UVM and connect it to the verification methods of VLSI circuits
2307423T.CEO.5: To introduce scripting languages and their use in VLSI technology at various stages.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307423T.CO.1: Apply the design flow steps for an ASIC, considering the design constraints [L3]
2307423T.CO.2: Examine timing analysis with different digital circuits [L4]
2307423T.CO.3: Demonstrate System Verilog features for the verification of digital circuits [L3].
2307423T.CO.4: Interpret UVM-based verification environments to verify ASIC/FPGA-based design [L3].
2307423T.CO.5: Extrapolate the scripts written to automate common tasks in the VLSI design flow [L2].

**COURSE ABSTRACT:**

This is the third course of the VLSI program Elective Track. This provides the advanced techniques in VLSI domain covers front end and back end flows. This course provides comprehensive knowledge of advanced techniques in ASIC design : moving towards sustainable industrialization in semiconductors (SDG9). Advanced topics such as STA, System Verilog for verification are also included, covering UVM and introduction to scripting languages. This curriculum equips students with the skills needed to tackle real-world challenges in VLSI design, fabrication, and testing.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Application Specific IC Design Aspect** | **08 HOURS** |

**Applications/Case Study:** Lattice semiconductors LPTM21x and L-ASC10, (programmable hardware management controllers and expanders)

**Contents:** Types of ASIC, abstraction levels, ASIC design flow, Area for the design, speed requirements, power requirements, design constraints, synchronous design considerations, Timing parameters, metastability, clock skew, slack, Clock Jitter, clock latency and on-chip variations.

**Further Readings/Self Study:** Back annotation in Physical design

| | | |
|---|---|---|
| **UNIT 2** | **Static Timing Analysis** | **08 HOURS** |

**Applications/Case Study:** Application of STA for performance optimization in VLSI design

**Contents:** STA at different phases, Standard cells, modelling of CMOS cells, switching waveform, propagation delay, Min and Max Timing Paths, Clock Domains, operating conditions, timing models - standard cell library, timing models - Combinational Cells.

**Further Readings/Self Study:** Timing constrains of a flip-flop

| | | |
|---|---|---|
| **UNIT 3** | **System Verilog and Verification** | **08 HOURS** |

**Applications/Case Study:** Functional verification of a digital stopwatch using System Verilog

**Contents:** System Verilog syntax and constructs, classes and randomization. Verification methodologies such as directed testing, constrained random testing and coverage driven verification.

**Further Readings/Self Study:** Formal verification techniques

| | | |
|---|---|---|
| **UNIT 4** | **Verification Using UVM** | **10 HOURS** |

**Applications/Case Study:** Ransomware attack on the University of Vermont Health Network

**Contents:** Introduction to Universal Verification Methodology (UVM), UVM base classes, Test bench structure UVM key components- test bench, transactions, phases, massaging and reporting, configuration, functional coverage.

**Further Readings/Self Study:** Best practices for UVM sequence development and stimulus generation

| UNIT 5 | VLSI Scripting | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Design rule violation reporting using custom scripts in IC layout tools

**Contents: Audio Networks:** Introduction to scripting in VLSI, Importance of Scripting languages in VLSI, Shell scripting, basic shell commands in Linux, variables and datatypes, command line arguments, functions and script organization.

**Further Readings/Self Study:** Scripting for design rule checks (DRC) and layout verification in VLSI tools

## TEXT BOOKS


1. Srikanth Vijayaraghavan and Meyyappan Ramanathan (2011). *A Practical Guide for System Verilog Assertions* . 1st Edition, Springer.
2. Derek Cheng (2014). *Automating VLSI Design and Verification: A Guide to Using TCL, Perl, and Python*. 1st Edition, Springer.
3. J. Bhashkar and Rakesh Chadha (2010). *Static Timing Analysis for Nano-meter Designs*. 1st Edition, Springer.
4. Yashwant Kanetkar (2000). *UNIX Shell Programming*. 1st Edition, BPB Publications.
5. Chris Spear, Greg Tumbush (2012). *System Verilog for verification- A guide to learning the Testbench Language features*. 3rd Edition, Springer science. ISBN:978-1-4614-0714-0


## REFERENCE BOOKS


1. Wayne Wolf (2012). *Modern VLSI Design: System-on-Chip Design*. 4th Edition, Pearson.
2. S. K. Gandhi (1983). *VLSI Fabrication Principle*. 1st Edition, John Wiley Inc., New York.
3. S .M. Sze (1988) . *VLSI Technolog*. 2nd Edition, McGraw Hill Co. Inc., New York.
4. Howard Johnson and Martin Graham (1993). *High-Speed Digital Design: A Handbook of Black Magic*. 1st Edition, Prentice Hall.
5. Dave Rich and Mark Glasser (2018). *UVM System Verilog: A Practical Guide*. 1st Edition, Springer.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2029 - 2030 (Rev. 2023(NEP)) |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Advance VLSI Design Lab |
| | COURSE CODE | 2307423L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : -- | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307423L.CEO.1: To introduce students to the ASIC design flow, including front-end and back-end design steps, with an emphasis on layout generation and physical design.

2307423L.CEO.2: To enable students to apply commercial and open-source EDA tools for performing Static Timing Analysis (STA) and generating comprehensive timing reports for digital designs.

2307423L.CEO.3: To develop analytical skills among students to identify and interpret setup and hold time violations in digital circuits using industry-standard STA tools.

2307423L.CEO.4: To equip students with the ability to develop basic automation scripts, streamlining repetitive VLSI design tasks through scripting and open-source tool integration.

2307423L.CEO.5: To foster an understanding of the Universal Verification Methodology (UVM) and its application in the functional verification of ASIC and FPGA-based systems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307421L.CO.1: Demonstrate the steps involved in ASIC design flow, including physical design aspects like layout generation [L3].

2307421L.CO.2: Use commercial and open-source EDA tools to perform Static Timing Analysis (STA) and generate timing reports [L3].

2307421L.CO.3: Interpret setup and hold time violations in digital circuits using STA tools [L4.]

2307421L.CO.4: Develop basic automation scripts to execute repetitive tasks using open-source VLSI tools [L3].

2307421L.CO.5: Analyze the Universal Verification Methodology (UVM) flow in the context of ASIC/FPGA verification [L2].

**COURSE ABSTRACT:**

The lab sessions provide practical exposure to ASIC design flow using industry-standard EDA tools, aligning with the goals of sustainable industrialization in semiconductors (SDG 9). Students will perform exercises in Static Timing Analysis (STA), verification using System Verilog and UVM, and basic scripting for automation. Through real-world design and simulation tasks, the course develops essential skills for tackling practical challenges in VLSI design, fabrication, and testing, preparing students for careers in semiconductor industries.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Hands-on ASIC Design Flow Including Layout Generation using EDA Tools | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Introduction to EDA tools for Physical Design/STA | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Generation of Timing report and its interpretation | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Analysis of Set-up and Hold time of given digital circuit | | |
| **PRACTICAL NO.05** | | **2 HOURS** |
| RTL to GDSII: Exploring the ASIC Design Flow | | |
| **PRACTICAL NO.06** | | **4 HOURS** |
| Introduction to scripting with open-source tools | | |
| **PRACTICAL NO.07** | | **2 HOURS** |
| Study of UVM flow | | |

## TEXT BOOKS


1. Srikanth Vijayaraghavan and Meyyappan Ramanathan (2011). *A Practical Guide for System Verilog Assertions* . 1st Edition, Springer.
2. Derek Cheng (2014). *Automating VLSI Design and Verification: A Guide to Using TCL, Perl, and Python*. 1st Edition, Springer.
3. J. Bhashkar and Rakesh Chadha (2010). *Static Timing Analysis for Nano-meter Designs*. 1st Edition, Springer.
4. Yashwant Kanetkar (2000). *UNIX Shell Programming*. 1st Edition, BPB Publications.
5. Chris Spear, Greg Tumbush (2012). *System Verilog for verification- A guide to learning the Testbench Language features*. 3rd Edition, Springer science. ISBN:978-1-4614-0714-0


## REFERENCE BOOKS


1. Wayne Wolf (2012). *Modern VLSI Design: System-on-Chip Design*. 4th Edition, Pearson.
2. S. K. Gandhi (1983). *VLSI Fabrication Principle*. 1st Edition, John Wiley Inc., New York.
3. S .M. Sze (1988) . *VLSI Technolog*. 2nd Edition, McGraw Hill Co. Inc., New York.
4. Howard Johnson and Martin Graham (1993). *High-Speed Digital Design: A Handbook of Black Magic*. 1st Edition, Prentice Hall.
5. Dave Rich and Mark Glasser (2018). *UVM System Verilog: A Practical Guide*. 1st Edition, Springer.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2029 - 2030 (Rev. 2023 (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Blockchain Technology and Applications |
| | **COURSE CODE** | 2306431T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 0.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2306431T.CEO.1: To understand how blockchain systems work.
2306431T.CEO.2: To securely interact with them.
2306431T.CEO.3: To Design, build, and deploy smart contracts and distributed applications.
2306431T.CEO.4: To Integrate ideas from blockchain technology into their own projects.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2306431T.CO.1: Apply blockchain architecture and consensus mechanisms (PoW, PoS, BFT) to understand secure data transactions in distributed networks [L3].
2306431T.CO.2: Analyze the role of cryptographic primitives (hashing, encryption, digital signatures) in ensuring transaction integrity and system security [L4].
2306431T.CO.3: Evaluate smart contract operations, Ethereum Virtual Machine (EVM) performance, and vulnerabilities to enhance decentralized application design [L5].
2306431T.CO.4: Design and integrate blockchain-based solutions for real-life applications like, IoT security, healthcare records, and industrial applications with emphasis on ethical and scalable deployment [L6].

**COURSE ABSTRACT:**

Decentralized blockchain-based systems, such as Bitcoin and Ethereum, are successful beyond all expectations. Although still in their infancy, they promise to revolutionize how we think of financial, information, and other infrastructures. This course covers the technical aspects of public distributed ledgers, blockchain systems, cryptocurrencies, and smart contracts. Students will learn how these systems are built, how to interact with them, how to design and build secure distributed applications.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Blockchain Technology** | **06 HOURS** |

**Applications/Case Study:** Blockchain Technology: Principles and Applications

**Contents:** Introduction to Blockchain Technology, The consensus problem Asynchronous Byzantine Agreement and its analysis, Abstract Models for BLOCKCHAIN -GARAY Model - RLA Model, Proof of Work ( PoW) as random oracle -formal treatment of consistency, liveness and fairness - Proof of Stake ( PoS) based Chains -Hybrid models ( PoW + PoS).

**Further Readings/Self Study:** Digital Cryptocurrencies

| | | |
|---|---|---|
| **UNIT 2** | **Cryptographic Foundations** | **06 HOURS** |

**Applications/Case Study:** Real life applications of cryptography

**Contents:** A Short Overview of Hashing, Signature Schemes, Encryption Schemes

**Further Readings/Self Study:** Cryptography and Network Security

| | | |
|---|---|---|
| **UNIT 3** | **Bitcoin - Wallet** | **06 HOURS** |

**Applications/Case Study:** Cryptocurrency exchanges like Coinbase and Binance

**Contents:** Basic Concept of Bitcoin, Merkley Tree - Hardness of Mining, Transaction Verifiability -Anonymity - Forks-Double Spending, Mathematical Analysis of Properties of Bitcoin

**Further Readings/Self Study:** Bitcoin and Cryptocurrency Technologies

| | | |
|---|---|---|
| **UNIT 4** | **Ethereum** | **06 HOURS** |

**Applications/Case Study:** Blockchain-based games

**Contents:** Ethereum Virtual Machine (EVM) Wallets for Ethereum, Smart Contracts - some attacks on smart contracts, Vulnerability, Attacks, Sidechain

**Further Readings/Self Study:** Supply Chain Management

| | | |
|---|---|---|
| **UNIT 5** | **Application and future of Blockchain** | **06 HOURS** |

**Applications/Case Study:** Discussion on various blockchain-based solutions for securing IoT devices and networks

**Contents:** Zero Knowledge proofs and protocols in Blockchain, Succinct non interactive argument for Knowledge ( SNARK), Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain, Zcash.

**Further Readings/Self Study:** Medical Record Management System using Blockchain

## TEXT BOOKS


1. William Stallings, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder.(2018). *"Cryptography and Network Security: Principles and Practice"*.
2. Chris Sanders, Jason Smith. (2016). *Bitcoin and cryptocurrency technologies: a comprehensive introduction*. Princeton University Press.


## REFERENCE BOOKS


1. Joseph Bonneau et al, SoK (2015). *Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy*. 2nd Edition, Cyber Simplicity Limited Publications. (article available for free download) curtain raiser kind of generic article, written by seasoned experts and pioneers.
2. J.A.Garay et al, (EUROCRYPT-2015). *The bitcoin backbone protocol - analysis and applications EUROCRYPT*. LNCS VOl 9057 ( VOLII ), pp 281-310.(Also available at eprint.iacr.org/2016/1048, discussions related to formal models for bitcoin protocols).
3. R.Pass et al, (EUROCRYPT-2017). *Analysis of Blockchain protocol in Asynchronous networks*. (eprint.iacr.org/2016/454) . A significant progress and consolidation of several principles).
4. R.Pass et al, (PODC-2017). *a fair blockchain*. (eprint.iacr.org/2016/916).

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2029 - 2030 (Rev. 2023 (NEP)) |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Project Management |
| | COURSE CODE | 2307476T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : -- | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307476T.CEO.1: To create awareness of organizational strategy for project implementation
2307476T.CEO.2: To understand the rules for creating a Work Breakdown Structure for a Project
2307476T.CEO.3: To illustrate approaches for risk identification and its assessment
2307476T.CEO.4: To apply quality and data-driven methods for improving processes and reducing defects in electronics, telecom, and start-up domains
2307476T.CEO.5: To adopt modern PM practices and digital tools for efficient execution of embedded and electronics projects

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307476T.CO.1: Apply project management principles to Electronics product development cycle from concept to execution.[L3]
2307476T.CO.2: Implement collaborative tools for project planning and tracking.[L3]
2307476T.CO.3: Analyze QA challenges in cross-domain systems.[L4]
2307476T.CO.4: Compare estimation techniques using the COCOMO framework and digital BoM/BoQ.[L4]

**COURSE ABSTRACT:**

Project Management course prepares future leaders to manage corporate and startup projects effectively while contributing to global sustainability. Students master essential concepts such as project life cycles, SMART goals, planning tools such as WBS and CPM, along with cost and risk management strategies. The course emphasizes Agile methodologies, lean planning, and iterative development, equipping learners to optimize resources, reduce waste, and drive economic growth. The course blends technical and managerial skills with ethical leadership and eco-efficient practices, ensuring that students are industry-ready with EDA tools expertise. This course cultivates project managers who can advance quality education, climate action, reduction inequalities, and partnerships for sustainable development.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Fundamentals and Initiation of Project Management** | **06 HOURS** |

**Applications/Case Study:** ASIC Design for 5G Baseband, Autonomous Drone for Precision Agriculture

**Contents:**Introduction, Objectives of Project Management, Project Manager, Managing of stakeholders, Agile Manifesto and Planning, Importance of PM in Electronics Industry, Project Life Cycle in Electronics product development (concept, prototype, test, mass production), RND strategy and TRL Levels in Electronics project selection.

**Further Readings/Self Study:** Project Portfolio Management (PPM) tool, Design for Manufacturability (DFM)

| | | |
|---|---|---|
| **UNIT 2** | **Electronics Project Planning and Execution** | **06 HOURS** |

**Applications/Case Study:** Cost over-run risks in Signal Processing system, Scheduling and resource allocation

**Contents:** Project Risk Management, Concept of Critical Path Method (CPM) and PERT, Defining project domains (VLSI,FPGA,IoT,PCB), WBS in Electronics systems (Hardware/Software/Test Blocks),Technology obsolescence, Breakdown activities in Electronics Projects, Project Closure

**Further Readings/Self Study:** EOL risks,Project Supervision Challenges

| | | |
|---|---|---|
| **UNIT 3** | **Risk Management in Electronics Projects** | **06 HOURS** |

**Applications/Case Study:** Thermal and Power consumption risks, Supply chain disruptions

**Contents:** Electronic component availability risk, Firmware Integration Risk, Procurement delays, Testing and validation failures (IEEE/ISO), Regulatory Compliance Risk (EMI/EMC), Quantitative Risk Assessment (QRA) Methodologies, Collaborative Platforms (Jira, Gantt Charts, Network Diagrams,Git).

**Further Readings/Self Study:** Kanban Boards, Trello, Pivotal Tracker

| UNIT 4 | Project Excellence in Corporate Context | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Virtual reality (VR) for remote project reviews, Computer Vision in PCB inspection.

**Contents:** Six Sigma to reduce rework and scrap in semiconductor plants, DRC (Design Rule Check) for quality assessment, ML algorithms for telecom infrastructure maintenance, KPI tracking dashboards (Metabase), QA in cross-domain integration, Total Quality Management (TQM) in electronic assembly lines, Use case: Electronics Start-up eco system.

**Further Readings/Self Study:** Edge AI in telecom systems, Quantum Computing in Electronics Project Management

| UNIT 5 | Recent Trends in Project Management | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Blockchain for secure project documentation, Augmented Reality (AR) for remote project review

**Contents:** Adoption of Scrum, Sprint and Retrospective call, Digital Twin Technology, PM trends: Salesforce CRM, ERP/PLM, Microsoft One-drive, 3D PCB Design, Cybersecurity in Embedded Projects, Digital BoM and BoQ, International Project Management, Use Case: COCOMO Framework in Electronics Projects

**Further Readings/Self Study:** DevOps for firmware projects, AI-assisted project analytics

## TEXT BOOKS AND E-SOURCES


1. John M. Nicholas and Herman Steyn (2008), *Project Management for Business, Engineering, and Technology,* 3rd Edition, Elsevier,ISBN 978-0750683999.
2. Eur Ing Albert Lester (2017),*Project Management Planning and Control: Managing Engineering, Construction, and Manufacturing Projects to PMI, APM, and BSI Standards,* 7th Edition, Elsevier Ltd. ISBN 978-0081020203.
3. *NPTEL Course Project Management (2025)* Link of the Course: https://onlinecourses.nptel.ac.in/noc25_mg78/preview
4. *NPTEL Course Project Management: Planning, Execution, Evaluation and Control (2025)* Link of the Course: https://onlinecourses.nptel.ac.in/noc25_mg127/preview


## REFERENCE BOOKS


1. Russ J. Martinelli and Dragan Z. Milosevic (2018), *Project Management Toolbox,* 2nd Edition, Wiley, ISBN 978-1118973127.
2. Kalpesh Ashar (2022),*Project Management Essentials You Always Wanted to Know,* 5th Edition, Vibrant Publishers, ISBN 194-9395792.
3. Christine Petersen (2013),*The Practical Guide to Project Management,* 1st Edition, Bookboon, ISBN 978-8740305241.
4. Russell W. Darnall and John M. Preston (2018), *Project Management: From Simple to Complex,* 2nd Edition, FlatWorld Knowledge, ISBN 978-1453386750.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2029 - 2030 (Rev. 2023(NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Major Project - III |
| | **COURSE CODE** | 2307491L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307491.CEO.1: To understand how to carry out performance evaluation and comparative analysis in appropriate form.

2307491.CEO.2: To know about standard industry practices.

2307491.CEO.3: To become familiar with the steps involved in identifying and selecting a good platform to present the work done.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307491.CO.1: Make use of standard industry practices [L3].

2307491.CO.2: Interpret the findings and compare them with the results in the literature [L5].

2307491.CO.3: Identify weaknesses and limitations in the findings and propose improvements [L3].

2307491.CO.4: Function as a team and communicate the work done by adhering to the norms of professional ethics [L4].

## COURSE ABSTRACT:

The project is most important part of undergraduate curriculum and enables students to develop an alytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Major Project - I, Major Project - II and Major Project - III. After successful completion of Major Project - II (Sem VI), next step is Major Project - III (Sem VII). The goal of this phase of the project is to draw Inferences and Detail Analysis/Final Testing/Re-development/etc. Showcasing the work - Technical documentation in Conferences/Journal/Patent/Product/Working model.

## GUIDELINES

1. Project group students of Sem VI would be continued in this semester VII.
2. The group members may be from different programs to support the interdisciplinary functioning.
3. Projects should preferably have a national/international, industry/academic/research collaboration.
4. Students should do extended implementation of their project in consultation with their advisor.
5. For extended implementation, objectives of Sem V and Sem VI should have been already achieved.
6. Every project should follow at least one standard industry practice while implementing. For example, below are some of the standard industry practices followed by Electrical engineers:
   (a) If writing a Matlab code, follow **MathWorks Advisory Board (MAB)** Guidelines
   (b) For embedded c coding, **Motor Industry Software Reliability Association (MISRA)** standards can be used
   (c) If antenna is manufactured, then get **EMI/EMC** testing certificate from National Accreditation Board for Testing and Calibration Laboratories.
7. Performance evaluation and Comparative analysis of results should be carried out and presented in appropriate form.
8. Carry out detail analysis to improve performance w.r.t Final Testing/Re-development/etc.
9. Showcase the work in Conferences/Journal/Patent/Product/Working model.

**Note:** *For guideline 6, every school should identify standard industry practices and try to incorporate in the projects.*

## ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Project Review I (Internal): (10 Marks)
2. Activity (Standard industry practices): (5 Marks)
3. Project Review II (External): (10 Marks)
4. Project Report: (5 Marks)
5. Every project group should publish paper in National conference / International conference / Participate in technical project competition (with achievement) / File a patent/etc.: (5 Marks)
6. Project: Final Presentation and Demonstration (External) (40 Marks)

**Note:**

- Report should be prepared in LaTeX.
- External examiner for Review 2 and Final Demo should be allocated same group.
- Report will be jointly evaluated by External examiner and Internal examiner.

## REFERENCES


1. Eng-Choon Leong et al (2015). Guide To Research Projects For Engineering Students. CRC press, Apple Academic Press Inc. ISBN: 9781482238778, 9781482238778.
2. Michelle Reid (2018). Report Writing (Pocket Study Skills). Second Edition, Macmillan Education.
3. Leslie Lamport (2011). A Document Preparation System LaTeX: User's Guide and Reference Manual. Pearson.


## E-RESOURCES

1. IEEE Author Center
2. Intellectual Property India - Indian Patent Office
3. FlowingData
4. Design and Analysis of Experiments

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2029 - 2030 (Rev. 2023 (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Research Methodology |
| | **COURSE CODE** | 2307492T |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : --** | **REVISION NO.** | 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307492T.CEO.1: To enable defining and formulating research approaches towards obtaining solutions to practical problems.

2307492T.CEO.2: To facilitate development of scientific oral and written communication skills.

2307492T.CEO.3: To comprehend the concepts behind adhering to scientific ethics and values.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2307492T.CO.1: Understand some basic concepts of research and its methodologies.

2307492T.CO.2: Define and apply appropriate parameters and research problems.

2307492T.CO.3: Develop skills to draft a research paper.

2307492T.CO.4: Analyse and comprehend the ethical practices in conducting research and dissemination of results in different forms.

## COURSE ABSTRACT:

Research methodology is a structured and scientific approach used to collect, analyze, and interpret quantitative or qualitative data to answer research questions or test hypotheses. A research methodology is like a plan for carrying out research and helps keep researchers on track by limiting the scope of the research. Several aspects must be considered before selecting an appropriate research methodology, such as research limitations and ethical concerns that may affect your research

A research methodology describes the techniques and procedures used to identify and analyze information regarding a specific research topic. It is a process by which researchers design their study so that they can achieve their objectives using the selected research instruments. It includes all the important aspects of research, including research design, data collection methods, data analysis methods, and the overall framework within which the research is conducted. While these points can help you understand what is research methodology, you also need to know why it is important to pick the right methodology.

## THEORY COURSE CONTENTS

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Research methodology** | **6 HOURS** |

**Contents:** Meaning of research, Types of research, Research process, Problem definition, Objectives of research, Research questions, Research design, Approaches to research, Quantitative vs. qualitative approach, Understanding theory, Building and validating theoretical models, Exploratory vs. confirmatory research, Experimental vs theoretical Research, Importance of reasoning in research.

| | | |
|---|---|---|
| **UNIT 2** | **Problem formulation** | **8 HOURS** |

**Contents:** Problem formulation, Conducting literature review, Referencing, Information sources, Information retrieval, Role of libraries in information retrieval, Tools for identifying literatures, Indexing and abstracting services, Citation indexes.

| | | |
|---|---|---|
| **UNIT 3** | **Result Analysis** | **6 HOURS** |

**Contents:** Experimental research, Cause effect relationship, Development of hypothesis, Measurement systems analysis, Error propagation, Validity of experiments , Statistical design of experiments , Field experiments, Data/Variable types & classification, Data collection, Numerical and graphical data analysis, Sampling, Observation, Surveys, Inferential statistics and interpretation of result.

| | | |
|---|---|---|
| **UNIT 4** | **Scientific Writing** | **4 HOURS** |

**Contents:** Preparation of dissertation and research papers, Tables and illustrations, Guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript, References, citation, and listing system of documents. Ethics of Research, Scientific Misconduct, Forms of Scientific Misconduct. Plagiarism, Unscientific practices in thesis work.

| | | |
|---|---|---|
| **UNIT 5** | **Intellectual property** | **4 HOURS** |

**Contents:** To give an idea about IPR, registration, patents,copyrights, and its enforcement.

## TEXT BOOKS


1. C. R. Kothari (2023). Research Methodology. New Age International Publishers, Fifth Edition, ISBN: 978-9389802559.
2. Ranjit Kumar (2024). Research Methodology: A Step by Step Guide for Beginners. SAGE Publications, Fourth Edition, ISBN: 978-9351501336.


## REFERENCE BOOKS


1. Shanti Bhushan Mishra, Shashi Alok (2017). Handbook of Research Methodology. Educreation, First Edition, ISBN: 978-1-5457-0340-3.
2. Chandra Vinod, Hareendran Anand (2017). Research Methodology. Pearson Education, First Edition, ISBN:978-9352863518.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| SCHOOL OF E&TC ENGINEERING | W.E.F | AY: 2029 - 2030 (Rev. 2023 (NEP)) |
| FINAL YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING | COURSE NAME | Summer Internship (Technical) |
| | COURSE CODE | 2307496L |
| | COURSE CREDITS | 4 |
| RELEASE DATE : -- | REVISION NO | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | NIL | 150 | 150 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2307496L.CEO.1: To enhance technical skills and self-directed learning.

2307496L.CEO.2: To develop adaptability and resilience in a multicultural or professional environment. product/system/software.

2307496L.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2307496L.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2307496L.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2307496L.CO.1: Analyse the organizational structure and workflow of a professional setup to identify opportunities for optimization and innovation [L4].

2307496L.CO.2: Design innovative products, systems, or software by integrating interdisciplinary knowledge and addressing real-world challenges [L5].

2307496L.CO.3: Collaborate effectively within multidisciplinary teams to achieve project objectives, demonstrating strategic decision-making and problem-solving skills [L4].

2307496L.CO.4: Evaluate industry-relevant practices through hands-on experience, enhancing professional competence and adaptability [L4].

2307496L.CO.5: Formulate comprehensive and innovative engineering problem statements by synthesizing technical knowledge and industry insights [L4].

2307496L.CO.6: Analyze project feasibility using cost estimation, budgeting, and financial metrics (ROI, payback, NPV) to support informed decisions during the internship [L5].

## INTRODUCTION

The Student Internship Program (SIP) aims to empower final-year entrants B.Tech. students by providing them with valuable opportunities to engage with industry and academic centers of excellence. Through SIP, students gain comprehensive practical experience that bridges the gap between classroom learning and real-world application.

The program is designed to cultivate professionalism, enhance networking capabilities, and strengthen academic and professional skills, ensuring students are well-prepared for the demands of todays competitive global market. By participating in internships, students can apply their academic knowledge in professional settings, fostering a deeper understanding of their field and equipping them with the expertise needed to excel in their future careers.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the final year of the B.Tech. program, to be undertaken during the summer break after Semester VI. This program aims to provide opportunities for skill enhancement through industrial internship or research internship exposure. The internship focuses on helping students identify and engage with relevant MNC, medium scale enterprise, or small-scale industries, or research organization to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

**Duration:** : 4 to 8 weeks (minimum of 160 hours).

**Timeframe:** Conducted during June-July of each academic year.

**Nature of Internship:**

1. Industrial internship with MNC or medium-scale industries.
2. Research internship in the CSIR lab or DRDO / IIT / IISc / NCL / NEERI etc

**Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the programs goals.

**Mentorship:** Each third-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development.

**Student Development Focus :**

Before selecting an internship option, second-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

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**1. Continuous Assessment (CA): Biweekly Progress Reports and interaction with faculty mentor (40%):**

Students must submit at least two progress reports during the internship/training period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them

**2. Detailed Project Report with Learning Outcomes (30%)**

Upon completion of the internship, students are required to submit a comprehensive minimum of 30 to 40 pages internship/project report. The report must include:

1. Overview of the Industry/Research Institute
2. Skills and knowledge acquired (technical).
3. Specific challenges addressed
4. Personal and professional growth reflections
5. Clearly stated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certificate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

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|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2029 - 2030 (Rev. 2023 (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Wireless Communication |
| | **COURSE CODE** | 2307413T |
| | **COURSE CREDITS** | 4 |
| **RELEASE DATE : --** | **REVISION NO.** | 0.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 4 | NIL | 60 | NIL | 90 | NIL | NIL | 150 |

**PREREQUISITE :** NIL

## COURSE OBJECTIVES :

2307413T.CEO.1: To introduce the students with the advances in communication technology using wireless network.

2307413T.CEO.2: To provide deep insights of multiple access Technology and Radio Access Networks in wireless communication.

2307413T.CEO.3: To familiarize the students with transmitter and receiver techniques in 5G communication.

2307413T.CEO.4: To make students to examine various core network linking techniques in 5G.

2307413T.CEO.5: To provide the exposure to determine hardware and software requirements for various mobile (UE) devices.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307413T.CO.1: Apply wireless communication principles to configure and analyze 5G network entities and service modes [L3].

2307413T.CO.2: Analyze multiple access techniques and RAN architectures to compare performance, coverage, and deployment strategies [L4].

2307413T.CO.3: Evaluate 5G core network blocks and linking methods to justify design choices based on latency, scalability, and cost [L5].

2307413T.CO.4: Design and build a 5G subsystem for specific use cases using modern tools [L6].

**COURSE ABSTRACT:**

5G Communication is a core telecommunication course that integrates theoretical concepts with practical insights into next-generation wireless technology. The course begins with a comprehensive review of mobile communication technologies from 1G to 4G, establishing the foundation for understanding 5G network architecture, operational modes, and key advancements such as MIMO systems, gNB architecture, and core network components. A detailed exploration follows, covering the connectivity of gNodeB to the core network and the integration of core networks with cloud systems. This course also emphasizes software-driven simulation, offering hands-on MATLAB exercises to model and analyze 5G network behavior. Furthermore, the role of 5G in industrial applications and IoT integration is examined, ensuring an informative approach to real-world deployments.

By blending structured learning with industry-relevant case studies, this course prepares learners to navigate the complexities of modern mobile communication systems, equipping them with essential technical knowledge for research, development, and practical implementation of 5G technologies.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to 5G features.** | **06 HOURS** |

**Applications/Case Study:** Proprietary or private radio network, its components and applications.
**Contents:** General Mobile network architecture, architectural advances from 1g to 5g, Frequency requirements of 5G, SA and NSA 5G, 5G Characterization of modes (eMBB, uRLLC, mMTC), the main functional entities in 5G Architecture (gNB, AMF, SMF, UPF, UDM, AUSF).
**Further Readings/Self Study:** 1G to 4G architecture study.

| | | |
|---|---|---|
| **UNIT 2** | **Multiple access techniques in 5G** | **08 HOURS** |

**Applications/Case Study:** Multiple access technology used in open standard digital radio technologies like DMR, APCO25.
**Contents: :** Single carrier and multiple carrier multiple access techniques, principles of MIMO system, MIMO-OFDM techniques, introduction to OFDM transmitter and receiver in 5G.
**Further Readings/Self Study: :** Use of OFDM in WiFI.

| | | |
|---|---|---|
| **UNIT 3** | **Radio Access Network in 5G** | **06 HOURS** |

**Applications/Case Study:** gnodeB blocks used by reputed mobile network provider. **Contents:** RAN types used in 1G to 4G. RAN types in 5G, Comparison of BTS, nodeB, enodeB, gnodeB. Modulation techniques, source and channel coding methods used in 5G, Architecture and functionality of gNodeB. Types of antennas (sector) used for RAN. Types of channels and frame structure in 5G.
**Further Readings/Self Study:** gNodeB interfaces in 4G/5G.

| | | |
|---|---|---|
| **UNIT 4** | **Microwave network in 5G** | **08 HOURS** |

**Applications/Case Study:** Microwave antennas used by reputed mobile network providers.
**Contents: : M**icrowave transmitter and receiver, Types of antennas used in microwave, Microwave link budget, MIMO technology for microwave link, Interconnection of microwave radios with gnodeB system, microwave and OFC connectivity with core network.
**Further Readings/Self Study:** Monitoring technology of microwave links in radio network.

| UNIT 5 | Core network of 5G | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Study of basic windows server configuration.

**Contents: Audio Networks:** 5G core network block diagram, voice and data network components, functions of NRF,PCF,BSF,UDM,AUSF,NWDAF blocks. Interfacing of core network to other networks like Internet.

**Further Readings/Self Study:** Study of database server and its components.

| UNIT 6 | User Equipment (UE) in 5G | 06 HOURS |
|---|---|---|

**Applications/Case Study:** 5G mobile unit.

**Contents: Audio Networks:** 5G mobile phone block diagram and function of each block. Software requirements of mobile phone, Mobile radiation, power consumption and battery back-up considerations, Interfacing sensors to 5G network.

**Further Readings/Self Study:** Interfacing of 5G network to sensors.

## TEXT BOOKS


1. Saad Z. Asif (2019). *5G Mobile Communications Concepts and Technologies* . 1st Edition, CRC Press, ISBN: 978-1498751551
2. NJonathan Rodriguez (2015). *Fundamentals 5G Mobile Networks* . 1st Edition, John Wiley & Sons, ISBN: 978-1118867525
3. Robert W. Heath Jr., Angel Lozano (2019). *Foundations of MIMO Communication* . 1st Edition, Cambridge University Press, ISBN: 978-0521762281.
4. Ahmed El Zooghby (2005). *Smart Antenna Engineering* . 3. ARTECH HOUSE, INC, ISBN: 978-1580535151.
5. Afif Osseiran, Jose F. Monserrat, Patrick Marsch (2016). *5G Mobile and Wireless Communications Technology* . Cambridge University Press, ISBN: 978-1107130098


## REFERENCE BOOKS


1. Naha, Abhi (2012). *Essentials of Mobile Handset Design* . 1st Edition, Cambridge University Press. ISBN 978-1107010048.
2. Erik Dahlman, Stefan Parkvall, and Johan Skold (2018). *5G NR: The Next Generation Wireless Access Technology* . 1st Edition, Academic Press. ISBN 13:978-0128143230.
3. Chen, W., Gaal, P., Montojo, J., & Zisimopoulos, H. (n.d.) (2018). *Fundamentals of 5G Communications: Connectivity for Enhanced Mobile Broadband and Beyond*. McGraw Hill.


## E-Resources

1. https://nptel.ac.in/courses/108105134
2. https://nptel.ac.in/courses/108/105/108105134/
3. https://www.udemy.com/course/5g-mobile-networksmodern-wireless-communication/ /-technology/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2029 - 2030 (Rev. 2023 (NEP)) |
| **FINAL YEAR BACHELOR TECHNOLOGY** | **COURSE NAME** | Capstone Portfolio |
| | **COURSE CODE** | 2307493L |
| | **COURSE CREDITS** | 08 |
| **RELEASE DATE : --** | **REVISION NO.** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| - | - | - | NIL | NIL | 150 | 150 | 300 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307493L.CEO.1: Identify solutions at different scales, ensuring sustainability within diverse engineering contexts.

2307493L.CEO.2: Develop a capstone project or research internship problem adhering to standard engineering practices with precision and accuracy.

2307493L.CEO.3: Organize artifacts and results through teamwork and effective communication under project or research internship constraints.

2307493L.CEO.4: Synthesize findings into a reflective report that communicates results with professional ethics.

2307493L.CEO.5: Create a professional portfolio showcasing achievements and growth aligned with engineering standards.

2307493L.CEO.6: Justify progressive growth in a portfolio, highlighting contributions to sustainability and teamwork.

## COURSE OUTCOMES :

After successful completion of the course, students will be able to,

2307493L.CO.1: To Analyze capstone research work and find sustainable solutions in diverse engineering contexts. [L4]

2307493L.CO.2: To Design a capstone research work using methodologies aligned with engineering standards. [L4]

2307493L.CO.3: To Compile artifacts and outcomes collaboratively within project or research internship constraints. [L3]

2307493L.CO.4: To Evaluate findings and prepare a reflective report adhering to ethical standards. [L5]

2307493L.CO.5: To Create a digital personal portfolio in engineering practices. [L4]

2307493L.CO.6: To present portfolio and graduation book reflecting contributions to sustainability and teamwork. [L4]

## COURSE ABSTRACT:

The capstone project is an individual, self-identified endeavor focusing on technical or non-technical challenges. It emphasizes risk-taking, high productivity, strong design research, and the creation of advanced solutions through innovative methodologies. Students are empowered to choose their projects, formulate solutions, negotiate deliverables, and work independently, culminating in a digital presentation. The capstone experience fosters critical thinking, problem-solving, and adaptability, aligning with professional engineering practices and research standards. A research internship complements this by exposing students to real-world applications of their skills, strengthening their ability to address complex challenges, and enhancing their professional preparedness. Together, the capstone project and internship provide a comprehensive platform for students to demonstrate their technical acumen and research capabilities. The digital portfolio and graduation book integrate these experiences into a cohesive collection of work that reflects the evolution of skills and ideas. Combining written and visual content, it showcases critical thinking, design processes, and final artifacts. Students craft a professional voice through reflective articles, personal design philosophies, and enhanced online profiles, such as on LinkedIn. This structured portfolio serves as a powerful tool to articulate achievements and establish a professional identity.

**ASSESSMENT and EVALUATION :**

The Jury will be appointed to monitor the progress and continuous evaluation of each project. One of the members will be the Capstone Research work internship supervisor. The evaluation shall be performed jointly by the supervisor and the jury members.

1. Continuous assessment (150 marks)
    - Capstone Research work Review 1 (75 Marks)
    - Capstone Research work Review 2 (75 Marks)
2. Final Presentation and Demonstration (150 Marks)
    - Digital Portfolio (50 Marks)
    - Graduation book (50 Marks)
    - Viva Voce (50 Marks)

Capstone portfolio is divided into two section a) Capstone Research work b) Digital Portfolio

## CAPSTONE RESEARCH WORK :

Individual student can choose the topic from one of the below capstones to carry out the work during the entire semester

1. Technical Capstone
    - Industry identified problem
    - Institute identified problem
    - Urban city identified problems
    - Rural Development
    - Environmental related problems
    - Student Conceived problems
    - Satisfactory solution to Open ended problems
    - Innovative Design stemming from Student/Faculty
    - Product Development
    - App/ Software Development
    - Multidisciplinary approach to existing problem
    - Modeling/Optimization/Analysis study
2. Writing Intensive Capstone
    - Design
    - Literature Survey
    - Commercial Survey
    - Social media Survey
    - Idea/ Design Philosophy
    - Research Methodology
    - Consultancy Project work
    - Collaborative Project work
    - Laboratory/Digital classroom
    - Manage/lead any Event/activity
3. TechFrontier Capstone
    - State of art
    - Challenges and Prospect of Technology (Engineering) Education in Primary and Secondary Schools
    - Market Statistics

## DIGITAL PORTFOLIO :

Individual student should create there own digital portfolio by using the standard professional platforms/blogs based on the record during their entire Under Graduate program. Digital portfolio should be professional, amalgamation of technical, written, graphical/Visual content and Verbal culmination of the skills and knowledge that students have developed over their under graduate program.

1. Process Portfolio
2. Show case Portfolio
3. Hybrid Portfolio

## GRADUATION BOOK :

A graduation book is a comprehensive document showcasing students' achievements, projects, and reflections during their academic journey. It serves as a portfolio and a keepsake, reflecting their growth and accomplishments.
It should basically covered following content or c vtext

1. Personal Portfolio: Focused on an individual students projects, awards, and career goals.
2. Class/Batch Book: Highlights collective achievements, group projects, and memorable moments of a graduating class.
3. Thematic Graduation Book: Centers on a specific theme, such as innovation, sustainability, or community impact, showcasing relevant work.

**GUIDELINES :**

1. Capstone Research Project: Each student is required to individually work on their capstone project throughout the semester, ensuring sustained focus and progress.
2. Title Approval: Students must propose a title for their capstone project, subject to approval by the Supervisor and School Dean.
3. Scope of Work: The approved topic must be pursued with extensive research, accurate data, the necessary evidence, and measurable results.
4. Digital Portfolio: Students must independently create a digital portfolio to showcase their capstone work and overall growth.
5. Graduation book: Each student must authored a detailed graduation book documenting the capstone project, following plagiarism guidelines.
6. Alignment with Capstone Work: The research internship should complement the capstone project, reinforcing technical expertise, research methods, and professional skills.
7. Supervisor and Department Review: Capstone work and digital portfolios must be evaluated by the Supervisor and another faculty member from the department to ensure adherence to guidelines and quality standards.
8. Exemplary Performance Review: Exceptional capstone work may qualify for a secondary review, termed as "Capstone Work Review 2," to evaluate the students competency. Supervisors may request a concise report if the work is deemed remarkable. Examples of exemplary achievements include:
    - Published articles in Scopus-indexed journals.
    - Approved research proposals.
    - Wins in design competitions, technical fests, or workshops.
    - Wins in state, national, or international events (technical/non-technical).
    - Valid scores in competitive exams (e.g., GATE, CAT, GRE, TOEFL, IELTS).
9. Capstone and Portfolio Assessment: Both the capstone project and digital portfolio will undergo a formal review by the supervisor and department faculty.
10. Jury Examination: The final examination will be conducted in the presence of a jury panel to evaluate the students overall performance and competency.
11. Initiative and Ownership: Students are expected to take ownership of their work, from choosing the title to completing the capstone project and research internship independently.
12. Quality and Ethics: Work submitted must meet academic standards, demonstrating quality, originality, and ethical research practices.

## REFERENCES


1. https://design.berkeley.edu/BerkeleyM.Des.UniversityofCalifornia,U.S.
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## E-RESOURCES

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3. https://www.masterclass.com/articles/how-to-make-a-digital-portfolio
4. https://issuu.com/solutions/design/portfolio

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2029 - 2030 (Rev. 2023 (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING** | **COURSE NAME** | Semester Long Internship Program (SLIP) |
| | **COURSE CODE** | 2307497L |
| | **COURSE CREDITS** | 8 |
| **RELEASE DATE : --** | **REVISION NO** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | 150 | 150 | 300 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2307497L.CEO.1: To get acquainted with the organization structure

2307497L.CEO.2: To gain learning and living experience

2307497L.CEO.3: To develop appropriate workplace attitudes

2307497L.CEO.4: To get Hands-on experience in the related field to relate and reinforce what has been taught at the university

2307497L.CEO.5: To formulate the problem statement

## COURSE OUTCOMES :

The students after completion of the course will be able to,

2307497L.CO.1: Analyze real-world engineering problems and propose effective solutions using domain-specific knowledge [L4].

2307497L.CO.2: Evaluate suitable problem-solving methodologies and modern tools to address practical engineering challenges [L5].

2307497L.CO.3: Demonstrate the ability to work effectively in cross-cultural and multidisciplinary teams within a professional environment [L4].

2307497L.CO.4: Develop and demonstrate teamwork, leadership, and communication skills required for collaborative and individual tasks [L4].

2307497L.CO.5: Apply ethical principles and commit to professional responsibilities and norms in engineering practice [L3].

2307497L.CO.6: Demonstrate awareness of the need for, and engage in, independent and lifelong learning to remain relevant in technological and professional domains [L4].

## INTRODUCTION

The Final-Year Semester-long internship program is structured to provide B.Tech. students with extended, in-depth exposure to real-world industrial environments and academic centers of excellence. Spanning 4 to 6 months, this internship serves as a vital bridge between academic coursework and professional practice, enabling students to apply theoretical knowledge to complex, practical challenges.

Through sustained engagement in industry settings, students develop critical technical competencies, professional ethics, and workplace readiness. The program nurtures a sense of responsibility, fosters independent thinking, and sharpens problem-solving and project management skills. It also enhances students ability to collaborate in multidisciplinary and multicultural teams, preparing them for dynamic, global work environments.

By immersing themselves in live projects, students gain hands-on experience, expand their professional network, and build the confidence and expertise necessary to transition seamlessly into their careers or pursue higher academic goals.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students the final year of the B.Tech. program, to be undertaken after Semester VII. This program aims to provide opportunities for skill enhancement through industrial internship or research internship exposure. The internship focuses on helping students identify and engage with relevant MNC, medium scale enterprise, or small-scale industries, or research organization to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

**Duration:** 16 to 24 weeks.

**Timeframe:** Conducted during Jan-June of each academic year.

**Nature of Internship:**

1. Industrial internship with MNC or medium-scale industries.
2. Research internship in the CSIR lab or DRDO / IIT / IISc / NCL / NEERI etc

**Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the programs goals.

**Mentorship:** Each final-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development.

**Student Development Focus :**

Before selecting an internship option, final-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures regular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

---

**1. Continuous Assessment (CA): (Biweekly Progress Reports, Faculty Mentor Interaction & Mid-Term Review) (50%)**

Students must submit biweekly progress reports during the internship period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them
- Regular interaction with the assigned faculty mentor is expected for guidance and monitoring. **A mid-term review will be conducted between the 8th and 12th week of the internship**. This review will evaluate the student's progress, alignment with learning objectives, and address any critical feedback for improvement. It will be considered as part of the CA component.

**2. Detailed Project Report with Learning Outcomes (20%)**

Upon completion of the internship, students are required to submit a comprehensive internship/project report (minimum 40 to 60 pages) which should include:

1. Overview of the Industry/Research Institute
2. Skills and knowledge acquired (technical).
3. Specific challenges addressed,
4. Reflections on personal and professional growth
5. Clearly articulated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certificate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **STUDENT OUTREACH PROGRAMME** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2029 - 2030 (Rev. 2023 (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Student Outreach Programme |
| | **COURSE CODE** | 2307498L |
| | **COURSE CREDITS** | 8 |
| **RELEASE DATE : --** | **REVISION NO** | NEP 2.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | 150 | 150 | 300 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2307498L.CEO.1: Provide students with practical exposure to real-world research and project challenges within different academic or industrial environments.

2307498L.CEO.2: Develop advanced problem-solving and analytical skills by addressing project-specific technical and innovative issues.

2307498L.CEO.3: Enhance intercultural communication, teamwork, and adaptability by working in diverse cultural and institutional contexts.

2307498L.CEO.4: Foster independent work ethics and collaborative skills to prepare students for professional engineering and research challenges globally.

**COURSE OUTCOMES :**

The students after completion of the course will be able to:

2307498L.CO.1: Analyze comprehensive project proposals including problem statements, constraints, and objectives relevant to their research work [L4].

2307498L.CO.2: Critically evaluate methodologies applied during their projects and justify the selection of solutions based on evidence and effectiveness [L5].

2307498L.CO.3: Demonstrate effective teamwork and cultural adaptability in cross-organizational settings to achieve collective objectives [L5].

2307498L.CO.4: Assess their growth in technical, interpersonal, and professional skills essential for succeeding in global and multicultural research environments [L5].

**COURSE ABSTRACT :**

The Student Research Exchange Program offers students an opportunity to undertake project work, case studies, or specialized coursework either internationally or nationally at partner institutions or organizations. This experience enhances academic knowledge, practical skills, and cultural awareness through engagement with diverse research environments and collaborative problem-solving. The program aims to develop global competencies, independent learning, and professional growth preparing students for multidisciplinary challenges and intercultural professional settings.

**GUIDELINES :**

1. Eligibility Criteria Students should have no live backlogs.
   Eligibility: Students must have cleared prerequisite courses and have no outstanding academic backlogs to participate.
   institutions internationally.
2. Application procedure.
   Students must submit a formal proposal including:
   Details of the host organization/university
   Project or research description or SOP
   Curriculum Vitae (CV)
   Academic transcript or mark sheets
3. Proposal submission is reviewed by the International relation cell or equivalent authority.

**Assessment and Evaluations**

1. Credit allocation is based on two presentations assessed by a panel (3-4 members from academic expert)
2. Presentation I (Mid-term) - Total 150 marks
3. Analyze and present problem statement, constraints, objectives, and initial findings (30 marks)
4. Evaluate problem-solving methods and justify chosen methodology (40 marks)
5. Demonstrate teamwork and cultural adaptability (40 marks)
6. Self-evaluate technical and interpersonal progress (40 marks)
7. Presentation II (End-term) - Total 150 marks
8. Present final outcomes and solution effectiveness (40 marks)
9. Critically evaluate methodology and suggest improvements (30 marks)
10. Demonstrate project teamwork culmination (40 marks)
11. Assess professional readiness and personal growth (40 marks)

## REFERENCES


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3. https://presidencyuniversity.in/life-at-presidency/international-engagement/student-exchange-program
4. https://jgu.edu.in/internationaloffice/semester-exchange-programmes
5. https://www.cuchd.in/international/semester-exchange.php

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **SCHOOL OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2029 - 2030 (Rev. 2023 (NEP)) |
| **FINAL YEAR BACHELOR OF TECHNOLOGY E&TC ENGINEERING** | **COURSE NAME** | Industry Practicum |
| | **COURSE CODE** | 2307499L |
| | **COURSE CREDITS** | 8 |
| **RELEASE DATE : --** | **REVISION NO** | 0.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | 150 | 150 | 300 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2307499L.CEO.1: To get acquainted with the organization structure

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2307499L.CEO.5: To formulate the problem statement

## COURSE OUTCOMES :

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2307499L.CO.1: Analyze real-world engineering problems and propose effective solutions using domain-specific knowledge [L4].

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## INTRODUCTION

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By immersing themselves in live projects, students gain hands-on experience, expand their professional network, and build the confidence and expertise necessary to transition seamlessly into their careers or pursue higher academic goals.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the final year of the B.Tech. program, to be undertaken after Semester VI. This program aims to provide opportunities for skill enhancement through industrial internship or research internship exposure. The internship focuses on helping students identify and engage with relevant MNC, medium scale enterprise, or small-scale industries, or research organization to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

**Duration:** 16 to 24 weeks.

**Timeframe:** Conducted during August-December of each academic year.

**Nature of Internship:**

1. Industrial internship with MNC or medium-scale industries.
2. Research internship in the CSIR lab or DRDO / IIT / IISc / NCL / NEERI etc

**Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the programs goals.

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- A valid internship completion certificate from the training organization must be submitted during the presentation.

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# MIT ACADEMY OF ENGINEERING, ALANDI

## Curriculum for

## Undergraduate Programme

## Bachelor of Technology in

## Artificial Intelligence

(Choice Based Credit System)

**NEP**

(Four Year Curriculum W.E.F, AY: 2026-27)

| BoS Chairman<br>ARTIFICIAL INTELLIGENCE | Member Secretary<br>Academic Council<br>Dean Academics | Chairman<br>Academic Council<br>Director MITAOE |
|---|---|---|

## INSTITUTE VISION

**To be a new age learning center for holistic development of students into professional engineers, to cater to the changing needs of techno-society.**

## INSTITUTE MISSION

- **Providing new-age infrastructural facilities blended with skill-based curriculum and activity-based pedagogical approaches to develop competitive engineering professionals to solve real-world problems.**
- **Preparing students for lifelong learning by transforming educational practices.**
- **Promoting ethical and moral values by involving students in community services.**
- **Inculcating an entrepreneurship and managerial skills by strengthening industry-institute interaction.**

## ARTIFICIAL INTELLEGENCE

### VISION

**A future-focused academic environment that empowers students through inclusive education, responsible innovation, and a commitment to driving societal progress professional engineers, to cater to the changing needs of techno-society.**

### MISSION

- **Innovation & Research:** To advance AI through quality education and research, foster innovation, and prepare ethical, industry-ready professionals to solve real-world challenges.
- **Academia-Industry Collaboration:** To empower students with industry-relevant AI skills through industry collaboration
- **Ethical Solutions:** To Develop ethical and transformative AI solutions for the betterment of global society.

## PROGRAM EDUCATIONAL OBJECTIVES(PEO's)

| PEO | PROGRAM EDUCATIONAL OBJECTIVES(PEO's) |
|---|---|
| PEO1 | **Artificial Intelligence Excellence & Innovation:** Apply AI knowledge and skills to innovate, research, and deliver ethical solutions in real-world professional contexts. |
| PEO2 | **Industry Readiness:** Demonstrate technical skills and adaptability for successful careers in industry and emerging AI domains. |
| PEO3 | **Ethical & Societal Impact:** Uphold ethical Artificial Intelligence practices and create transformative solutions for global benefit. |

## WASHINGTON ACCORD PROGRAM KNOWLEDGE AND ATTITUDE PROFILE (WKs)

| WK No. | WASHINGTON ACCORD PROGRAM KNOWLEDGE AND ATTITUDE PROFILE (WKs) | PO |
|---|---|---|
| WK1 | A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences. | PO1, PO2, PO6 |
| WK2 | Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline. | PO1, PO2, PO5 |
| WK3 | A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline. | PO1, PO2 |
| WK4 | Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline. | PO1, PO2 |
| WK5 | Knowledge, including efficient resource use, environmental impacts, whole-life cost,reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area. | PO3, PO6 |
| WK6 | Knowledge of engineering practice (technology) in the practice areas in the engineering discipline. | PO5 |
| WK7 | Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development. | PO6 |
| WK8 | Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues. | PO4 |

| | | |
|---|---|---|
| **WK9** | Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes. | **PO11** |

## PROGRAM OUTCOMES (PO's)

| PO | PROGRAM OUTCOMES (PO's) | WK |
|---|---|---|
| **PO1** | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. | **(WK1 to WK4)** |
| **PO2** | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | **(WK1 to WK4)** |
| **PO3** | **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | **(WK5)** |
| **PO4** | **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | **(WK8)** |
| **PO5** | **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. | **(WK2 and WK6)** |
| **PO6** | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. | **(WK1, WK5, and WK7)** |
| **PO7** | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. | **(WK9)** |

| | | |
|---|---|---|
| PO8 | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | -- |
| PO9 | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | -- |
| PO10 | **Project management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. | -- |
| PO11 | **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | **(WK8)** |

## PROGRAM SPECIFIC OUTCOMES (PSO's)

| PSO | PROGRAM SPECIFIC OUTCOMES (PSO's) |
|---|---|
| PSO1 | **Solution Development-** integrate intelligent systems using contemporary AI models, tools, and data pipelines tailored to solve real-world, domain-specific problems. |
| PSO2 | **Computational System Design** - Design AI components and workflows to enhance system efficiency, scalability, and decision-making. |
| PSO3 | **Professional Impact** - Integrate Artificial Intelligence and computer science engineering knowledge for ethical, innovative, and sustainable applications. |

**MIT Academy of Engineering, Alandi, Pune**
**An Autonomous Institute affiliated to Savitribai Phule Pune University**

**COMMON CURRICULUM FRAMEWORK (NEP )**

The Bachelor of Technology Program shall be based on the following type of courses.

| COURSE AND CREDIT DISTRIBUTION: SEMESTER-WISE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **S.N.** | **TYPE OF COURSE** | **NO. OF COURSES/SEMESTER (CREDITS)** | | | | | | | | **Total Courses** | **Total Credits** | **%** |
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | | | |
| 1. | Basic Science Courses (BSC) | 2(8) | 2(7) | | | | | | | **4** | **15** | **9** |
| 2. | Engineering Science (ESC) | 3(8) | 2(6) | | | | | | | **5** | **14** | **9** |
| 3. | Program Core Course (PCC) | | 1(2) | 3(10) | 3(10) | 2(8) | 2(8) | 1(4) | 1(4) | **13** | **46** | **27** |
| 4. | Program Elective Course (PEC) | | | | | 1(4) | 1(4) | 1(4) | 1(3) | **4** | **15** | **9** |
| 5 | Vocational and Skill Enhancement Course (VSEC) | 1(2) | 1(2) | 1(2) | 1(2) | 1(2) | 1(2) | | | **6** | **12** | **7** |
| 6 | Multi-Disciplinary Minor(MDM) | | | | 1(3) | 1(3) | 1(3) | 1(2) | 1(3) | **5** | **14** | **8** |
| 7 | Open Elective (OE) | | | 1(2) | 1(4) | | | | 1(2) | **3** | **8** | **5** |
| 8 | Ability Enhancement Courses (HSSM AEC) | | 1(2) | | | | 1(2) | | | **2** | **4** | **2** |
| 9 | Management/Entrepreneurship/Economics Courses (HSSM MEC) | | | | 1(2) | | | 1(2) | | **2** | **4** | **2** |
| 10 | Indian Knowledge System (HSSM IKS) & Co-curricular (CC) | 2(3) | 1(2) | | | | | | | **3** | **5** | **3** |
| 11 | Value Education Course (HSSM VEC) | | | 2(5) | | | | | | **2** | **5** | **3** |
| 12 | Experiential Learning/ Project/ Field Work/ Community (ELC PRJ) | | | 1(1) | 1(1) | 1(2) | 1(2) | 2(4) | | **6** | **10** | **6** |
| 13 | Experiential Learning Summer/ Semester Long Internship (ELC SI) | | | 1(2) | | 1(2) | | 1(4) | 1(8) | **4** | **16** | **10** |
| **Audit Courses** | | **1** | | | **1** | | | | | **2** | **0** | **0** |
| **TOTAL** | | **9 (21)** | **8 (21)** | **9 (22)** | **9 (22)** | **7 (21)** | **7 (21)** | **7 (20)** | **5 (20)** | **61** | **168** | **100** |

| CREDITS (CONTACT HOURS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 Lecture Hour = 1 Credit, 2 Lab Hours = 1 Credit, 1 Tutorial Hour = 1 Credit | | | | | | | |
| SL. NO. | YEAR | SEMESTER CREDIT | | | SEMESTER CONTACT HOURS | | |
| | | 1 | 2 | TOTAL | 1 | 2 | TOTAL |
| 1. | First Year | 21 | 21 | 42 | 27 | 31 | 58 |
| 2. | Second Year | 22 | 22 | 44 | 34 | 28 | 62 |
| 3. | Third Year | 21 | 21 | 42 | 27 | 31 | 58 |
| 4. | Final Year | 20 | 20 | 40 | 19(10) | 14 | 33(24) |
| TOTAL | | | | 168 | | | 211(202) |

| COURSE CATEGORIES ABBREVIATION | |
|---|---|
| BSC | Basic Science Course |
| ESC | Engineering Science Course |
| PCC | Programme Core Course |
| PEC | Programme Elective Course |
| MDM | Multi-Disciplinary Minor |
| OE | Open Elective |
| VSEC | Vocational and Skill Enhancement Course |
| HSSM AEC | Humanities Social Science Management Ability Enhancement Courses |
| HSSM MEC | Humanities Social Science Management/Entrepreneurship/ Economics Course |
| HSSM IKS | Humanities Social Science Management Indian Knowledge System |
| HSSM VEC | Humanities Social Science and Management Value Education Course |
| ELC PRJ | Experiential Learning Course Project/ Field Work/ Community Engagement Project |
| ELC SI | Experiential Learning Course Student's Internship (Summer/ Semester Long/ Year Long) |
| CC | Co-Curricular Courses |

| ABBREVIATIONS | | | |
|---|---|---|---|
| TH | Theory Lecture | CA | Continuous Assessment |
| P | Practical Lab | T/P | Term Work / Practical |
| TU | Tutorial | DM | Demonstration |
| IA | Internal Assessment | Lab | Laboratory |
| MSE | Mid Semester Exam | | |
| ESE | End Semester Exam | | |

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

# MIT ACADEMY OF ENGINEERING, ALANDI

## Curriculum for

## First Year

## Bachelor of Technology

## Artificial Intelligence

**NEP REVISION**

(With Effect from Academic Year:)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP ) | | |
|---|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W. E. F. | : | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| SEMESTER: I Artificial Intelligence | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2301119A - Universal Human Values (Induction Program) | | | | | | | | | | | | |
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT/TUT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| BSC | 2301101T | Calculus and Differential Equations | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301101TU | Calculus and Differential Equations Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 |
| BSC | 2301104T | Science of Nature | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301104L | Science of Nature Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2304101T | Foundations of Computing | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2304101L | Foundations of Computing Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2303101T | Applied Mechanics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2303101L | Applied Mechanics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2309101T | Design Thinking | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2309101L | Design Thinking Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| VSEC | 2311161T | Data Driven Modeling | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2311161L | Data Driven Modeling Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| CC | 2301182L | Liberal Learning | - | 2 | - | - | - | - | - | 50 | 50 | 1 |
| HSSM IKS | 2311181T | Indian Knowledge System (Vedic Mathematics) | 2 | - | - | 25 | - | 50 | - | - | 75 | 2 |
| TOTAL | | | 14 | 12 | 1 | | | | | | 825 | 21 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP ) | | |
|---|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W. E. F. | : | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| BSC | 2301103T | Statistics and Integral Calculus | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301103TU | Statistics and Integral Calculus Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 |
| BSC | 2301102T | Engineering Physics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2301102L | Engineering Physics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2307101T | Electrical and Electronics Engineering | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2307101L | Electrical and Electronics Engineering Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2303101T | Essentials of Data Science | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2303101L | Essentials of Data Science Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| VSEC | 2311162T | Data Visualization | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2311162L | Data Visualization Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| PCC | 2311111T | Discrete Structure | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| HsSMAEC | 2301111L | Communication Skills (English) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2301112/3/4T | Communication Skills (German/Japanese/ French) | 2 | - | - | 35 | - | 40 | - | - | | |
| CC | 2307183L | Creative Technologies | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| **TOTAL** | | | **14** | **16** | **1** | | | | | | **825** | **21** |

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# MIT ACADEMY OF ENGINEERING, ALANDI

## Curriculum for

## Second Year

## Bachelor of Technology

## Artificial Intelligence

**NEP (2.0)**

(With Effect from Academic Year:)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP ) | | |
|---|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W. E. F. | : | |
| SECOND YEAR BACHELOR OF TECHNOLOGY | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: III (Artificial Intelligence)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2311211T | Data Structures & Algorithms | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2311211L | Data Structures & Algorithm Lab | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| PCC | 2311212T | Artificial Intelligence | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| PCC | 2311213T | Operating System | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| VSEC | 2311261L | Problem Solving Using OOP(C++) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2311262L | Problem-Solving Using OOP(Java) | | | | | | | | | | |
| HSSM VEC | 2301287 | Universal Human Values-II | 1 | 4 | - | - | - | 25 | - | 75 | 100 | 3 |
| OE | 2301257T | Applied Mathematics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | *OE List | Open Elective Course | | | | | | | | | | |
| | 2301257L | Applied Mathematics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | *OE List | Open Elective Course Lab | | | | | | | | | | |
| OE | 23BD251L | Prototyping | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 23XX25X | Open Elective | 2 | - | - | 35 | - | 40 | - | - | | |
| ELC PRJ | 2311291L | Project Design | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| **TOTAL** | | | **14** | **20** | **-** | | | | | | **800** | **22** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP ) | | |
|---|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W. E. F. | : | |
| SECOND YEAR BACHELOR OF TECHNOLOGY | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| SEMESTER: IV (Artificial Intelligence) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2311216T | Database Management System | 3 | - | - | 30 | 20 | 50 | - | - | 100 | | 3 |
| | 2311216L | Database Management System Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| PCC | 2311217T | Machine Learning | 2 | - | - | 15 | 20 | 40 | - | - | 75 | | 2 |
| | 2311217L | Machine Learning Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| PCC | 2311218T | Computer Network | 3 | - | - | 30 | 20 | 50 | - | - | 100 | | 3 |
| VSEC | 2311268L | Object Oriented Programing (Core Java) | - | 4 | - | - | - | - | 35 | 40 | 75 | | 2 |
| | 2311269L | Enterprise Application Development (Advanced Java) | | | | | | | | | | | |
| MDM | *MDM List | MDM Course-I | 2 | - | - | 15 | 20 | 40 | - | - | 75 | | 2 |
| | *MDM List | MDM Course-I Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| HSSM VEC | 2301286T | Environmental Science | 2 | - | - | 35 | - | 40 | - | - | 75 | | 2 |
| HSSM MEC | 2301276 | Entrepreneurship Skills | 1 | 2 | - | - | - | 25 | 20 | 30 | 75 | | 2 |
| ELC PRJ | 2311292L | Project Implementation | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| ELC SI | 2311296L | Internship (Life And Soft Skills) | - | - | - | - | - | - | - | 75 | 75 | | 2 |
| Audit | 2301281A | Indian Constitution | 1 | - | - | - | - | - | - | - | Audit | | |
| TOTAL | | | 14 | 14 | - | | | | | | 850 | | 22 |

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# MIT ACADEMY OF ENGINEERING, ALANDI

## Curriculum for

## Third Year

## Bachelor of Technology

## Artificial Intelligence

**NEP**

(With Effect from Academic Year:)

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| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP ) | | |
|---|---|---|---|
| DEPARTMENT OF ARTIFICIAL | W. E. F. | : | |

| THIRD YEAR BACHELOR OF TECHNOLOGY | RELEASE DATE | : | |
|---|---|---|---|
| | REVISION NO | : | NEP |

| SEMESTER: V (Artificial Intelligence) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2311311T | Design and Analysis of Algorithms | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2311311L | Design and Analysis of Algorithms Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| PCC | 2311312T | Deep Learning | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2311312T | Deep Learning Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| PEC | 2311321T | Cloud Computing Foundation | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2311322T | Embedded System | | | | | | | | | | | |
| | 2311323T | Foundations of Quantum Computing | | | | | | | | | | | |
| | 2311324T | Foundations of High Performance Computing | | | | | | | | | | | |
| | 2311321L | Cloud Computing Foundation Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| | 2311322L | Embedded System Lab | | | | | | | | | | | |
| | 2311323L | Foundations of Quantum Computing Lab | | | | | | | | | | | |
| | 2311324L | Foundations of High Performance Computing lab | | | | | | | | | | | |
| VSEC | 2311361L | Python Automation | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| | 2311362L | Full Stack Development | | | | | | | | | | | |
| | 2311363L | Applied Cloud and AI Services | | | | | | | | | | | |
| | 2311364L | UI/UX Design | | | | | | | | | | | |
| MDM | *MDM List | MDM Course-II | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| | *MDM List | MDM Course-II Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| ELC PRJ | 2311391L | Major Project - I | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| ELC SI | 2311396L | Internship (Technical) | - | - | - | - | - | - | - | 75 | 75 | 2 | |
| TOTAL | | | 11 | 16 | - | | | | | | 800 | 21 | |

| | REVISION NO. | : | NEP |
|---|---|---|---|

| SEMESTER: VI (Artificial Intelligence) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2311313T | Software Engineering | 3 | 2 | - | 30 | 20 | 50 | 20 | 30 | 100 | | 3 |
| PCC | 2311314T | Generative AI | 3 | - | - | 30 | 20 | 50 | - | - | 100 | | 3 |
| | 2311314L | Generative AI Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| PEC | 2311326T | Cloud Native Application Development | 3 | - | - | 30 | 20 | 50 | - | - | 100 | | 3 |
| | 2311327T | Edge AI | | | | | | | | | | | |
| | 2311328T | Quantum Machine Learning | | | | | | | | | | | |
| | 2311329T | High Performance Acceleration | | | | | | | | | | | |
| | 2311326L | Cloud Native Application Development Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| | 2311327L | Edge AI Lab | | | | | | | | | | | |
| | 2311328L | Quantum Machine Learning Lab | | | | | | | | | | | |
| | 2311329L | High Performance Acceleration Lab | | | | | | | | | | | |
| VSEC | 2311366L | Software Testing & Automation | - | 4 | - | - | - | - | 35 | 40 | 75 | | 2 |
| | 2311367L | Agentic AI | | | | | | | | | | | |
| MDM | *MDM List | MDM Course-III | 2 | - | - | 15 | 20 | 40 | - | - | 75 | | 2 |
| | *MDM List | MDM Course-III Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | | 1 |
| HSSM AEC | 2301371L | Employability and Career Development | - | 4 | - | - | - | - | 35 | 40 | 75 | | 2 |
| ELC PRJ | 2311392L | Major Project - II | - | 4 | - | - | - | - | 35 | 40 | 75 | | 2 |
| TOTAL | | | 11 | 20 | - | | | | | | 800 | | 21 |

*Four Credit Internship needs to be completed after Completion of the Third Year

# MIT ACADEMY OF ENGINEERING, ALANDI

# Curriculum for

# Final Year

# Bachelor of Technology

# Artificial Intelligence

## NEP

(With Effect from Academic Year:)

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| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP ) | | |
|---|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W. E. F. | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

**SEMESTER: VII Artificial Intelligence (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2311411T | System Design | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 2311421T | Big Data Analytics | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2311422T | Business Intelligence | | | | | | | | | | |
| | 2311423T | MLOPs for AI Practitioner | | | | | | | | | | |
| | 2311421L | Big Data Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| | 2311422L | Business Intelligence Lab | | | | | | | | | | |
| | 2311423L | MLOPs for AI Practitioner Lab | | | | | | | | | | |
| MDM | *MDM List | MDM Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| HSSM MEC | 2311476T | Project Management | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2311491L | Major Project - III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC PRJ | 2311492T | Research Methodology | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC SI | 2311496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| TOTAL | | | 13 | 6 | - | | | | | | 750 | 20 |

| SEMESTER: VIII Artificial Intelligence(PART A) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
| | | | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2311412T | Cyber Security | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 231142XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2311SWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MDM | *MDM List | MDM Course-V | 3 | - | - | 40 | | 60 | - | - | 100 | 3 |
| | 2311SWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| OE | 230145XX | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 23XX497L | Semester-Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 23XX498L | Semester Exchange | - | - | - | - | - | - | | | | |
| | 23XX493L | Capstone Portfolio | - | - | - | - | - | - | | | | |
| **TOTAL** | | | **10** | **4** | **-** | | | | | | **725** | **20** |

*Credits earned in advance through a credit transfer scheme

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE STRUCTURE (NEP )** | | |
|---|---|---|---|
| **Artificial Intelligence** | **W.E.F** | **:** | |
| **EXIT CRITERIA BACHELOR OF TECHNOLOGY** | **RELEASE DATE** | **:** | |
| | **REVISION NO.** | **:** | **NEP** |

| Program | Exit after | Courses | Credits | Total |
|---|---|---|---|---|
| ARTIFICIAL | First | Internship | 4 | 8 |

| | | | | |
|---|---|---|---|---|
| INTELLIGENCE | Year | Database Management System | 4 | |
| | Second Year | Internship | 4 | 8 |
| | | Software Engineering | 4 | |
| | Third Year | Internship | 4 | 8 |
| | | Human-Computer Interaction | 4 | |

| Basic Science Courses (BSC): 4 Courses and 15 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301101T | Calculus and Differential Equations | 4 |
| 2. | 2301104T | Science of Nature | 3 |
| | 2301104L | Science of Nature Lab | 1 |
| 3. | 2301103T | Statistics and Integral Calculus | 3 |
| | 2301103T | Statistics and Integral Calculus Lab | 1 |
| 4. | 2301102T | Engineering Physics | 2 |
| | 2301102L | Engineering Physics Lab | 1 |

| Engineering Science (ESC):5 Courses and 14 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |

| | | | |
|---|---|---|---|
| 1. | 2304101T | Foundations of Computing | 2 |
| | 2304101L | Foundations of Computing Lab | 1 |
| 2. | 2303101T | Applied Mechanics | 2 |
| | 2303101L | Applied Mechanics Lab | 1 |
| 3. | 2309101T | Design Thinking | 1 |
| | 2309101L | Design Thinking Lab | 1 |
| 4. | 2307101T | Electrical and Electronics Engineering | 2 |
| | 2307101L | Electrical and Electronics Engineering Lab | 1 |
| 5. | 2304102T | Essentials of Data Science | 2 |
| | 2304102L | Essentials of Data Science Lab | 1 |

| **Program Core Course (PCC): 13 Courses and 46 Credits** | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2311111T | Discrete Structure | 2 |
| 2. | 2311211T | Data Structures & Algorithms | 3 |
| | 2311211L | Data Structures & Algorithm Lab | 2 |
| 3. | 2311212T | Artificial Intelligence | 2 |
| 4. | 2311213T | Operating System | 3 |
| 5. | 2311216T | Database Management System | 3 |
| | 2311216L | Database Management System Lab | 1 |
| 6. | 2311217T | Machine Learning | 2 |
| | 2311217L | Machine Learning Lab | 1 |
| 7. | 2311218T | Computer Network | 3 |
| 8. | 2311311T | Design & Analysis of Algorithms | 3 |
| | 2311311L | Design & Analysis of Algorithms Lab | 1 |
| 9. | 2311312T | Deep Learning | 3 |
| | 2311312L | Deep Learning Lab | 1 |
| 10. | 2311313T | Computational Linguistics and Compiler Theory | 3 |
| | 2311313L | Computational Linguistics and Compiler Theory Lab | 1 |
| 11. | 2311314T | Generative AI | 3 |
| | 2311314L | Generative AI Lab | 1 |
| 12. | 2311411T | System Design | 4 |
| 13. | 2311412T | Cyber Security | 4 |

| Program Elective Course (PEC): 4 Courses and 15 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2311321T | Cloud Computing Foundation | 3 |
| | 2311322T | Embedded Systems | |
| | 2311323T | Foundations of Quantum Computing | |
| | 2311324T | Foundations of High Performance Computing | |
| | 2311321L | Cloud Computing Foundation Lab | 1 |
| | 2311322L | Embedded System Lab | |
| | 2311323L | Foundations of Quantum Computing Lab | |
| | 2311324L | Foundations of High Performance Computing lab | |
| 2. | 2311326T | Cloud Native Application Development | 3 |
| | 2311327T | Edge AI | |
| | 2311328T | Quantum Machine Learning | |
| | 2311329T | High Performance Acceleration | |
| | 2311326L | Cloud Native Application Development Lab | 1 |
| | 2311327L | Edge AI Lab | |
| | 2311328L | Quantum Machine Learning Lab | |
| | 2311329L | High Performance Acceleration Lab | |
| 3. | 2311421T | Big Data Analytics | 3 |
| | 2311422T | Business Intelligence | |
| | 2311423T | MLOPs for AI Practitioner | |
| | 2311421L | Big Data Analytics Lab | 1 |
| | 2311422L | Business Intelligence Lab | |
| | 2311423L | MLOPs for AI Practitioner Lab | |
| 4. | 2311SWXX | SWAYAM Course | 3 |

| List of SWAYAM Courses | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2311SW01 | SWAYAM Course | 3 |
| 2. | 2311SW02 | SWAYAM Course | |
| 3. | 2311SW03 | SWAYAM Course | |
| 4. | 2311SW04 | SWAYAM Course | |
| 5. | 2311SW05 | SWAYAM Course | |

| Vocational and Skill Enhancement Course (VSEC): 6 Courses and 12 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2311161T | Data Driven Modeling | 1 |
| | 2311161L | Data Driven Modeling Lab | 1 |
| 2. | 2311162T | Data Visualization | 1 |
| | 2311162L | Data Data Visualization Lab | 1 |
| 3. | 2311261L | Problem-Solving Using Object Oriented Programming (C++) | 2 |
| | 2311262L | Problem-Solving Using Object Oriented Programming (Java) | |
| 4. | 2311268L | Object Oriented Programming (Core Java) | 2 |
| | 2311269L | Enterprise Application Development (Advance Java) | |
| 5. | 2311361L | Python Automation | 2 |
| | 2311362L | Full Stack Development | |
| | 2311363L | Mobile Application Development | |
| | 2311364L | UI/UX Design | |
| 6. | 2311366L | Automation Testing | 2 |
| | 2311367L | Agentic AI | |
| | 2311368L | Robotic Process Automation | |

| Open Elective (OE): 3 Courses and 8 Credits | | | | |
|---|---|---|---|---|
| **Sl. No.** | **Offering DEPARTMENT** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | SHES (Mathematics) | 2301251T | Applied Mathematics | 3 |
| | | 2301251L | Applied Mathematics Lab | 1 |
| | | 2301252T | Applied Mathematics | 3 |
| | | 2301252L | Applied Mathematics Lab | 1 |
| | | 2301253T | Applied Mathematics | 3 |
| | | 2301253L | Applied Mathematics Lab | 1 |
| | | 2301254T | Applied Mathematics | 3 |
| | | 2301254L | Applied Mathematics Lab | 1 |
| | | 2301255T | Applied Mathematics | 3 |
| | | 2301255L | Applied Mathematics Lab | 1 |
| | | 2301256T | Applied Mathematics | 3 |
| | | 2301256L | Applied Mathematics Lab | 1 |
| | | 2301257T | Applied Mathematics | 3 |
| | | 2301257L | Applied Mathematics Lab | 1 |
| 2. | B. Design | 23BD251T | Prototyping | 2 |
| 3. | SHES | 230145XXL | Professional Certification Course | 2 |

| Humanities Social Science and Management Ability Enhancement Courses (HSS AEC): 2 Courses and 4 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301111L | Communication Skills (English) | 2 |
| | 2301112/3/4T | Communication Skills (German/Japanese/French) | |
| 2. | 2301371L | Employability and Career Development | 2 |

| Humanities Social Science Management/Entrepreneurship/Economics(HSS MEC): 2 Courses and 4 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301276 | Entrepreneurship Skills | 2 |
| 2. | 2311476T | Project Management | 2 |

| Humanities Social Science and Management Value Education Course (HSSM VEC): 3 Courses and 5 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2301119A | Universal Human Values-I | Audit |
| 2. | 2301286T | Environmental Science | 2 |
| 3. | 2301287 | Universal Human Values-II | 3 |

| Humanities Social Science and Management Indian Knowledge System / Co-Curricular Courses (HSSM IKS / CC): 4 Courses and 5 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2311181T | Indian Knowledge System - (Vedic Mathematics) | 2 |
| 2. | 2301182L | Liberal Learning - (HSSM CC) | 1 |
| 3. | 2307183L | Creative Technologies - (HSSM CC) | 2 |
| 4. | 2301281A | Indian Constitution | Audit |

| Experiential Learning Course Project/Field Work/Community Project(ELC PRJ): 6 Courses and 10 Credit | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2311291L | Project Design | 1 |
| 2. | 2311292L | Project Implementation | 1 |
| 3. | 2311391L | Major Project - I | 2 |
| 4. | 2311392L | Major Project - II | 2 |
| 5. | 2311491L | Major Project - III | 2 |
| 6. | 2311492T | Research Methodologies | 2 |
| Optional | 2311493L | Capstone Portfolio | 8 |

| Experiential Learning Course Student's Internship (Summer/Semester Long) (ELC SI): 4 Courses and 16 Credits | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **Course Credits** |
| 1. | 2311296L | Internship (Life And Soft Skills) | 2 |
| 2. | 2311396L | Internship (Technical) | 2 |
| 3. | 2311496L | Summer Internship (Technical) | 4 |
| 4. | 2311497L | Semester Long Internship | 8 |
| Optional | 2311498L | Semester Exchange | |
| Optional | 2311499L | Industry Practicum | 8 |

| Multi-Disciplinary Minor (MDM) List: 05 Courses and 14 Credits | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Programme Name | Track Name | Semester IV (MDM-I, 3 Credits) | | Semester V (MDM-II, 3 Credits) | | Semester VI (MDM-III, 3 Credits) | | Semester VII (MDM-IV, 2 Credits) | | Semester VIII (MDM-V, 3 Credits) | |
| | | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name | Course Code | Course Name |
| | | | | | | | | | | | |
| Chemical Engineering | Chemical Engineering (Green Technology and Sustainability Engineering) | 2301232 (T+L) | Engineering Informatics (T+L) | 2305331 (T+L) | Sustainability & Green Technology (T+L) | 2305332 (T+L) | Sustainable Bio-energy and Bio-products (T+L) | 2305431T | Green energy conversion systems | 2305SWXX | SWAYAM Course |
| | Chemical Engineering (Industrial Technology Management) | 2301232 (T+L) | Engineering Informatics (T+L) | 2305333 (T+L) | Management of Technology (T+L) | 2305334 (T+L) | Product Management (T+L) | 2305432T | Product Design and Process Development | 2305SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| Civil Engineering | Civil Engineering (Infrastructure and Sustainability | 2301232 (T+L) | Engineering Informatics (T+L) | 2303331 (T+L) | Smart Cities (T+L) | 2303332 (T+L) | Sustainable Engineering (T+L) | 2303431T | Integrated Environmental Planning & Assessment | 2303SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| Computer Engineering | Computer Engineering | 2301232 (T+L) | Engineering Informatics (T+L) | 2304331 (T+L) | Data Structures & Algorithms (T+L) | 2304332 (T+L) | Database Management Systems (T+L) | 2304431T | Software Engineering | 2304SWXX | SWAYAM Course |
| | | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Software Engineering** | **Software Engineering** | 2301232 (T+L) | Engineering Informatics (T+L) | 2310331 (T+L) | Software Architecture (T+L) | 2310332 (T+L) | Software Testing (T+L) | 2310431T | Software Quality Management | 2310SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| **Computer Science & Engineering (AIML)** | **Artificial Intelligence and Machine Learning** | 2301232 (T+L) | Engineering Informatics (T+L) | 2311331 (T+L) | Artificial Intelligence & Machine Learning (T+L) | 2311332 (T+L) | Deep Learning (T+L) | 2311431T | Generative AI | 2311SWXX | SWAYAM Course |
| | **Healthcare Technologies** | 2301232 (T+L) | Engineering Informatics (T+L) | 2311333 (T+L) | Fundamentals of Healthcare Technologies (T+L) | 2311334 (T+L) | Healthcare Informatics (T+L) | 2311432T | AI in Healthcare | 2311SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| **Computer Science & Engineering (DS)** | **Data Science** | 2301232 (T+L) | Engineering Informatics (T+L) | 2312331 (T+L) | Data Analytics (T+L) | 2312332 (T+L) | Predictive Analytics (T+L) | 2312431T | Big Data Analytics | 2312SWXX | SWAYAM Course |
| **Multi-Disciplinary Minor (MDM): 05 Courses and 14 Credits** | | | | | | | | | | | |
| **Programme Name** | **Track Name** | **Semester IV (MDM-I, 3 Credits)** | | **Semester V (MDM-II, 3 Credits)** | | **Semester VI (MDM-III, 3 Credits)** | | **Semester VII (MDM-IV, 2 Credits)** | | **Semester VIII (MDM-V, 3 Credits)** | |
| | | **Course Code** | **Course Name** | **Course Code** | **Course Name** | **Course Code** | **Course Name** | **Course Code** | **Course Name** | **Course Code** | **Course Name** |
| | | | | | | | | | | | |
| **Information Technology** | **Cloud Computing** | 2301232 (T+L) | Engineering Informatics (T+L) | 2308331 (T+L) | Cloud Computing Foundations (T+L) | 2308332 (T+L) | Cloud-Native Application Development (T+L) | 2308431T | Cloud Native DevOps | 2308SWXX | SWAYAM Course |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Electronics Engineering** | **Blockchain Technologies** | 2301232 (T+L) | Engineering Informatics (T+L) | 2306331 (T+L) | Cyber Security Essentials (T+L) | 2306332 (T+L) | Network Security (T+L) | 2306431T | Blockchain Technology Applications | 2306SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| **Mechanical Engineering** | **Computer Aided Engineering and Automation** | 2301232 (T+L) | Engineering Informatics (T+L) | 2309331 (T+L) | CAD Automation and Customisation (T+L) | 2309332 (T+L) | Computer Aided Simulation (T+L) | 2309431T | Industrial Automation | 2309SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| **SHES (Entrepreneurship)** | **Innovation and Entrepreneurship** | 2301232 (T+L) | Engineering Informatics (T+L) | 2301331 (T+L) | Foundation of Entrepreneurship (T+L) | 2301332 (T+L) | Venture Development | 2301431T | Startup Incubation & Fund Raising | 2301SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| **MITACSC** | **Business Administration** | 2301232 (T+L) | Engineering Informatics (T+L) | 2301333 (T+L) | Principles and Practices of Management (T+L) | 2301334 (T+L) | Organizational Behavior | 2301432T | Managerial Economics | 2301SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| **SHES** | **Lean Management** | 2301232 (T+L) | Engineering Informatics (T+L) | 2301335 (T+L) | Foundations of Lean Manufacturing Process | 2301336 (T+L) | Advance Lean manufacturing | 2301433T | Lean Manufacturing Project | 2301SWXX | SWAYAM Course |
| | | | | | | | | | | | |
| **B. Design** | **Design for Engineers** | 2301232 (T+L) | Engineering Informatics (T+L) | 23BD331 (T+L) | Design Fundamentals | 23BD332 (T+L) | Packaging Design | 23BD431 | Introduction to UI-UX | 23BDSWXX | SWAYAM Course |

**An Autonomous Institute affiliated to SavitribaiPhule Pune University**

## ELIGIBILITY CRITERION

FIRST YEAR ADMISSION

1) MAHARASHTRA STATE CANDIDATURE CANDIDATE.

The Candidate should be an Indian National, Passed HSC or its equivalent examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry or Biotechnology or Biology or Technical or Vocational subjects and obtained at least 50 % marks(at least 45% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only) in the above subjects taken together. Passed Diploma in Engineering and Technology and obtained at least 50% marks (at least 45 % marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only). Passed B.Sc. Degree from a Recognised University as defined by UGC and obtained at least 50 % marks (at least 45 % marks, in case of backward class categories and Persons with Disability candidates belonging to Maharashtra State only). Obtained score in CET conducted by the Competent Authority.

2) ALL INDIA CANDIDATURE CANDIDATES, JAMMU AND KASHMIR MIGRANT CANDIDATURE CANDIDATES.

The Candidate should be an Indian National.
Passed HSC or its equivalent examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry or Biotechnology or Biology or Technical or Vocational subjects and obtained at least 50 % marks (at least 45 % marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only) in the above subjects taken together.
OR
Passed Diploma in Engineering and Technology and obtained at least 50 % marks (at least 45 % marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only).
OR
Passed B.Sc. Degree from a Recognised University as defined by University Grants Commission and obtained at least 50 % marks (at least 45 % marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only).
Obtained score in CET or JEE Main Paper I.
Any other criterion declared by appropriate authority from time to time.

## MIT Academy of Engineering, Alandi, Pune

## An Autonomous Institute affiliated to SavitribaiPhule Pune University

## PROGRAMME OBJECTIVES

### Artificial Intelligence

The program aims to provide a professionally guided education in Artificial Intelligence that equips graduates with the knowledge, skills, and ethical grounding required to excel in diverse career paths, including industry, research, higher studies, entrepreneurship, and professional advancement.

Within four years of graduation, the alumni of the program are expected to:

1. Demonstrate technical agility in designing, developing, and deploying AI-driven software systems and intelligent solutions, addressing challenges in a dynamic global computing landscape.
2. Exhibit effective leadership and collaboration in multidisciplinary and multicultural environments, managing AI and data-driven projects with innovation and responsibility.
3. Apply ethical and societal perspectives in the design and implementation of AI-based technologies, ensuring fairness, transparency, and sustainability.
4. Pursue continuous learning and professional growth through engagement with emerging technologies, research, and lifelong skill development in computational, analytical, and communication domains.

## Examination Manual

(Excerpt from the Examination Manual)

### The Grading System

i) For every course taken by a student he/she is assigned a grade based on his/her performance in all the assessments including ISE, IA and ESE. Performance is first quantified as marks and then assigned letter grades

The grade indicates a qualitative assessment of the student's performance and is associated with an equivalent number called a grade point.

ii) The academic performance shall be graded on a 10 point scale. The letter grades and their equivalent grade points are listed in Table II.

iii) The Absolute grading system is followed, grades are allotted as per the Table below

| Grades | Range of Marks | Grade Points | Description |
|---|---|---|---|
| AA | 80-100 | 10 | Outstanding |
| AB | 70-79 | 9 | Excellent |
| BB | 60-69 | 8 | Very good |
| BC | 55-59 | 7 | Good |
| CC | 50-54 | 6 | Satisfactory |
| CD | 45-49 | 5 | Average |
| DD | 40-44 | 4 | Marginal |
| FF | 00-39 | 0 | Fail (Permitted to repeat ESE) |
| XX | | -- | Detained (Re register for the course) |
| NP | | -- | Absent for the examination |

| | | | |
|---|---|---|---|
| | | | (Permitted to repeat ESE) |
| PP | | -- | Completed the Audit Course successfully |
| NN | | -- | Not completed the audit course |

Table II : The grading System

iii) The letter grades (up to DD only) awarded to a student in all the courses shall be converted into a semester and cumulative grade point average to be calculated following the procedure given in section 10.2.

**The Grading Process**

i) The marks of the ISE, IA and ESE will be used to decide the total marks for each student. If the total has a fractional part then it shall be rounded off to the next integer.

ii) The grades will then be assigned to each student.

iii) The grades will be then examined and verified by the Examination Moderation committee.

**Performance Indices**

**Calculation of Semester Grade Point Average (SGPA)**

The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the Semester.

$$\text{SGPA} = \frac{\sum_{i=1}^{n} C_i P_i}{\sum_{i=1}^{n} C_i}$$

Where,

Ci= The number of credits earned in the ith course of a semester for which SGPA is to be calculated.

Pi=Grade point earned in the ith course i=1, 2, , n represent the number of courses in which a student is registered in the concerned semester The SGPA is calculated to two decimal places.

**Calculation of Cumulative Grade point Average (CGPA)**

An up-to-date assessment of the overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is the weighted average of the grade points obtained in all the courses in prescribed semesters for the UG/PG Programs. CGPA for a student of undergraduate/postgraduate Programs shall be calculated only when the grade point (minimum up to pass marks) of all the semester examinations is available.

$$\mathrm{CGPA} = \frac{\sum_{j=1}^{N} C_j \, \mathrm{SGPA}_j}{\sum_{j=1}^{N} C_j}$$

Where,

Cj =The number of credits earned in the jth course up to the semester for which CGPA is to be calculated.

Pj =Grade point earned in the jth course. A grade point less than 4 in a undergraduate course shall not be taken into consideration for calculation of CGPA. j = 1, 2,, m represent the number of courses in which a student is registered up to

the semester for which the CGPA is to be calculated.

The CGPA is also calculated to two decimal places.

**Guidelines for the Award of Grades:**

The following are the general guidelines for the award of grades:

i) For each student, all evaluations in different components of a course shall be done in absolute marks considering the weight-age in teaching scheme.

ii) The marks of various components shall be added to get total marks secured on a 10- points scale. The rounding off shall be done on the higher side.

iii) An Examination moderation committee will be responsible for examining and analyzing the results.

iv) The course in-charge, course faculty and Grade moderation committee's decision regarding grade thresholds and grade allotment will be final

Explanation for Grades

i) **Passing Grades** -The grades AA, AB, BB, BC, CC, CD and DD are passing grades. A candidate acquiring any one of these grades in a course shall be declared as passed. A student shall earn the credits for a course only if the student gets passing grade in that course.

**ii) FF Grade**

a) Letter grade FF in any course implies failure in that course.

b) A student who was awarded "FF" grade in a course has to repeat it compulsorily

when it is offered next and until a passing grade is obtained.

**iii) The Transitional Grades NP and XX shall be awarded in the following cases:**

a) Grade NP to a student only on satisfactory attendance at classes and performance in other components of assessment, but absence from ESE/ECE

in a semester for valid and convincing reasons acceptable to the Department, such as,

a. Illness or accident, which disabled him/her from appearing at the examination;
b. A calamity in the family at the time of the examination, which required the student to be away from the College;

b) Grades XX to a student on his/her overall performance in the course during the semester. This grade will be awarded to a student who is detained in that particular course.

iv) Both the SGPA and CGPA shall be rounded off to the second place of decimal and recorded as such for ease of presentation. Whenever the CGPAs are to be used for the purpose of determining the merit ranking in a group of students, only the rounded off values shall be made use of.

v) A student is considered to have completed a course successfully and earned the credits if he/she secures a letter grade other than NP, XX or FF in that course.

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MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

# MIT ACADEMY OF ENGINEERING, ALANDI

## Curriculum for First

# Year
# Bachelor of Technology

# Artificial Intelligence

(With Effect from Academic Year:

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP ) | | |
|---|---|---|---|
| DEPARTMENT OF COMPUTE SCIENCE AND ENGINEERING (AIML) | W. E. F. | : | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | RELEASE DATE | : | - |
| | REVISION NO. | : | NEP |

| SEMESTER: I Artificial Intelligence | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2301119A - Universal Human Values (Induction Program) | | | | | | | | | | | | | |
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT/TUT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| BSC | 2301101T | Calculus and Differential Equations | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301101TU | Calculus and Differential Equations Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 |
| BSC | 2301104T | Science of Nature | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301104L | Science of Nature Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2304101T | Foundations of Computing | 2 | - | - | 15 | 20 | 40 | 20 | 30 | 100 | 2 |
| ESC | 2303101T | Applied Mechanics | 2 | - | - | 15 | 20 | 40 | 20 | 30 | 100 | 3 |
| ESC | 2309101T | Design Thinking | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2309101L | Design Thinking Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| VSEC | 2311161T | Data Driven Modeling | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2311161L | Data Driven Modeling Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| CC | 2301182L | Liberal Learning | - | 2 | - | - | - | - | - | 50 | 50 | 1 |
| HSSM IKS | 2311181T | Indian Knowledge System (Vedic Mathematics) | 2 | - | - | 25 | - | 50 | - | - | 75 | 2 |
| TOTAL | | | 14 | 12 | 1 | | | | | | 825 | 21 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP ) | | |
|---|---|---|---|
| DEPARTMENT OF Artificial Intelligence | W. E. F. | : | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | RELEASE DATE | : | - |
| | REVISION NO. | : | - |

| SEMESTER: II Artificial Intelligence | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| BSC | 2301103T | Statistics and Integral Calculus | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2301103TU | Statistics and Integral Calculus Tutorial | - | - | 1 | - | - | - | 20 | 30 | 50 | 1 |
| BSC | 2301102T | Engineering Physics | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2301102L | Engineering Physics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2307101T | Electrical and Electronics Engineering | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2307101L | Electrical and Electronics Engineering Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ESC | 2303101T | Essentials of Data Science | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2303101L | Essentials of Data Science Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| VSEC | 2311162T | Data Visualization | 1 | - | - | 15 | - | 20 | - | - | 35 | 1 |
| | 2311162L | Data Visualization Lab | - | 2 | - | - | - | - | 20 | 20 | 40 | 1 |
| PCC | 2311111T | Discrete Structure | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| HsSM | 2301111L | Communication Skills (English) | - | 4 | - | - | - | - | 35 | 40 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AEC | 2301112/ 3/4T | Communication Skills (German/Japanese/ French) | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| CC | 2307183L | Creative Technologies | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| **TOTAL** | | | **14** | **16** | **1** | | | | | | **825** | **21** |

Two Credit Internships need to be completed after Completion of the First Year.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Calculus and Differential Equations |
| | COURSE CODE | 2301101T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | - |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**COURSE OBJECTIVES :**

2301101T.CEO.1: To apply the concepts of partial differentiation.

2301101T.CEO.2: Demonstrate an understanding towards the applications of partial differentiation.

2301101T.CEO.3: Examine methods for solving first-order first-degree ordinary differential equations.

2301101T.CEO.4: Infer the applications of first-order differential equations.

2301101T.CEO.5: Determine the solution of linear differential equations of second and higher order.

2301101T.CEO.6: Solve first-order linear and nonlinear partial differential equations.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301101T.CO.1: Make use of properties of partial differentiation to solve the problems [L3]. 2301101T.CO.2: Examine the applications of partial differentiation [L4].

2301101T.CO.3: Solve first-order and first-degree ordinary differential equations [L3]. 2301101T.CO.4: Analyze real-world phenomenon governed by first-order ordinary differential equations[L4].

2301101T.CO.5: Apply concepts of solving linear differential equations of second and higher order governing different systems in engineering [L4].

2301101T.CO.6: Determine solutions of various partial differential equations by theoretical methods [L3].

**COURSE ABSTRACT**

The course focuses on developing important mathematical concepts in a comprehensible, coherent and rigorous way. This is achieved by means of a carefully balanced approach by including the topics of calculus and differential equations which will foster the analytical thinking, and problem solving abilities of the students. Students are encouraged to apply their mathematical knowledge to solve problems and clear their doubts through tutorial sessions. Students embarking on this course will be able to identify and solve various differential equation problrms and will be intellectually equipped with the links between these concepts and their core engineering and real life problems. This course will enable them to tackle the problems of differential equations that they encounter in other engineering courses.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **Partial Differentiation** | **08 HOURS** |
| **Contents:** Partial Differentiation: Introduction, Chain rule, Total derivative, Change of variables, Homogeneous functions, Euler's theorem, Differentiation of implicit functions.<br>**Self Study:** Differentiation of implicit functions. | | |
| **UNIT 2** | **Applications Of Partial Differentiation** | **07 HOURS** |
| **Applications/Case Study:** Maxima, Minima.<br>**Contents:** Jacobian, Jacobian of implicit functions, Partial derivative of an implicit function using Jacobians, Functional dependence, Maxima and Minima of functions of two variables.<br>**Self Study:** Jacobian of implicit functions. | | |
| **UNIT 3** | **Ordinary Differential Equations Of First Order And First Degree** | **07 HOURS** |
| **Contents:** Exact differential equations, Differential equations, Reducible to exact form-Integrating factors, Linear differential equations, Differential equations reducible to linear form.<br>**Self Study:** Differential equations reducible to linear form. | | |
| **UNIT 4** | **Applications Of Ordinary Differential Equations Of First Order & First Degree** | **07 HOURS** |
| **Applications/Case Study:** Electrical circuits.<br>**Contents:** Orthogonal trajectories, Newton's law of cooling, Growth & Decay, Electric circuits, Chem- ical applications- Mixing problems.<br>**Self Study:** Newton's law of cooling, Growth & Decay. | | |
| **UNIT 5** | **Linear Differential Equation Of Second Order & Higher Order** | **08 HOURS** |

**Applications/Case Study:** Mass-Spring systems.

**Contents:** General solutions of linear differential equations with constant coefficients,Shortcut meth- ods to find P.I., Method of variation of parameters, Equations reducible to linear differential equations with constant coefficients: Cauchy and Legendre's linear differential equations.

**Self Study:** Cauchy and Legendre's linear differential equations.

**Further Readings:** Simultaneous differnetial equations, Applications in Electric circuits, Mass-Spring systems etc.

| UNIT 6 | Partial Differential Equations | 08 HOURS |
|---|---|---|

**Contents:** Introduction and formation of a partial differential equation, solution of a partial differential equation, equations solvable by direct integration, Linear differential equations of the first order, Non- linear differential equations of the first order, Charpit's method.

**Further Readings:** Linear Homogeneous Partial Differential Equations.

**TEXT BOOKS**


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.
2. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.


**REFERENCE BOOKS**


Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379- 8858). Addison-Wesley.

Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.

Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.

O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.

Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Calculus and Differential Equations Tutorial |
| | COURSE CODE | 2301101TU |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 1 | NIL | NIL | NIL | 20 | 30 | 50 |

**COURSE OBJECTIVES :**

2301101TU.CEO.1: To apply the concepts of partial differentiation.

2301101TU.CEO.2: Demonstrate an understanding towards the applications of partial differentiation.

2301101TU.CEO.3: Examine methods for solving first-order first-degree ordinary differential equations.

2301101TU.CEO.4: Infer the applications of first-order differential equations.

2301101TU.CEO.5: Determine the solution of linear differential equations of second and higher order.

2301101TU.CEO.6: Solve first-order linear and nonlinear partial differential equations.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301101TU.CO.1: Make use of properties of partial differentiation to solve the problems [L3].

2301101TU.CO.2: Examine the applications of partial differentiation [L4].

2301101TU.CO.3: Solve first-order and first-degree ordinary differential equations [L3]. 2301101TU.CO.4: Analyze real-world phenomenon governed by first-order ordinary differential equations[L4].

2301101TU.CO.5: Apply concepts of solving linear differential equations of second and higher order governing different systems in engineering [L4].

2301101TU.CO.6: Determine solutions of various partial differential equations by theoretical methods [L3].

**COURSE ABSTRACT**

The course focuses on developing important mathematical concepts in a comprehensible, coherent and rigorous way. This is achieved by means of a carefully balanced approach by including the topics of calculus and differential equations which will foster the analytical thinking, and problem solving abilities of the students. Students are encouraged to apply their mathematical knowledge to solve problems and clear their doubts through tutorial sessions. Students embarking on this course will be able to identify and solve various differential equation problrms and will be intellectually equipped with the links between these concepts and their core engineering and real life problems. This course will enable them to tackle the problems of differential equations that they encounter in other engineering courses.

| **TUTORIALS** | | |
|---|---|---|
| **TUTORIAL NO.01** | **Partial Differentiation** | **01 HOUR** |
| Problems On Partial Differentiation: Introduction, Chain rule, Total derivative, Change of variables. | | |
| **TUTORIAL NO.02** | **Partial Differentiation** | **01 HOUR** |
| Problems On Homogeneous functions, Euler's Theorem, Differentiation of Implicit functions. | | |
| **TUTORIAL NO.03** | **Applications of Partial Differentiation** | **01 HOUR** |
| Problems on Jacobian, Jacobian of Implicit functions, Partial derivative of an implicit function. | | |
| **TUTORIAL NO.04** | **Applications of Partial Differentiation** | **01 HOUR** |
| Problems on Functional dependence, Maxima and Minima of functions of two variables. | | |
| **TUTORIAL NO.05** | **Ordinary Differential Equations** | **01 HOUR** |
| Problems on Exact differential equations, Differential equations reducible to exact form- Integrating factors. | | |
| **TUTORIAL NO.06** | **Ordinary Differential Equations** | **01 HOUR** |
| Linear differential equations, Differential equations reducible to linear form. | | |
| **TUTORIAL NO.07** | **Applications of Ordinary Differential Equations** | **01 HOUR** |
| Orthogonal Trajectories, Newton's law of cooling, Growth & Decay. | | |
| **TUTORIAL NO.08** | **Applications of Ordinary Differential Equations** | **01 HOUR** |
| Electric circuits, Chemical applications- Mixing problems. | | |
| **TUTORIAL NO.09** | **Linear Differential Equations of Higher Order** | **01 HOUR** |
| General solutions of linear differential equations with constant coefficients, Shortcut methods to find P.I. | | |
| **TUTORIAL NO.10** | **Linear Differential Equations of Higher Order** | **01 HOUR** |

| |
|---|
| Shortcut methods to find P.I., Method of variation of parameters, Cauchy and Legendre's linear differ- ential equation. |

| | | |
|---|---|---|
| **TUTORIAL NO.11** | **Partial Differential Equations** | **01 HOUR** |
| Introduction and formation of partial differential equation, solution of a partial differential equation, equations solvable by direct integration. | | |
| **TUTORIAL NO.12** | **Partial Differential Equations** | **01 HOUR** |
| Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method. | | |
| **TUTORIAL NO.13** | **Guest Lecture** | **02 HOUR** |
| Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method. | | |
| **TUTORIAL NO.14** | **Doubt Clearing Session** | **01 HOUR** |
| Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method. | | |

**TEXT BOOKS**


1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.
2. Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.


**REFERENCE BOOKS**


Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379- 8858). Addison-Wesley.

Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.

Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.

O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.

Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF CHEMICAL ENGINEERING | W.E.F | AY |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Science of Nature |
| | COURSE CODE | 2301104T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2301104T.CEO.1: Make students conversant with basic Biology regarding the life processes.
2301104T.CEO.2: Study biology and engineering as biologically inspired technologies like designs in nature, bioenergetics, bioprocesses, biomaterials, biomechanics, and bioinstrumen- tation.
2301104T.CEO.3: To define the role of chemistry for engineers via atomic structure and green chemistry principles.
2301104T.CEO.4: To define the basic aspects and applications of polymers, biomaterials & composites.
2301104T.CEO.5: To illustrate the basic principles, instrumentation & applications of analytical techniques.
2301104T.CEO.6: To outline the technology involved in improving quality of water for its industrial use.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301104T.CO.1: Explain important biological inventions that changed human life and their impact on engineering [L2].

2301104T.CO.2: Describe different biological processes with their technical aspects for Healthcare and environmental applications [L2].

2301104T.CO.3: Utilize knowledge of atomic structure, purification - separation techniques and green chemistry principles to evaluate their significance and application in engineering con- texts [L3].

2301104T.CO.4: Implement chemical bonding theories and engineering material principles to assess the formation and properties of materials, including smart materials and nanomaterials, for their practical use in engineering solutions [L3].

2301104T.CO.5: Employ the basic principles and instrumentation techniques to perform and interpret analytical techniques relevant to engineering [L3].

2301104T.CO.6: Apply various technology strategies for water analysis and purification for improv- ing water quality, focusing on its industrial applications, and ensuring adherence to environmental standards [L3].

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **Introduction to Science of Nature** | **8 HOURS** |
| **Contents:** The basics of science of nature. Exploring science in nature, specially symmetry, spiral, golden ratio, pattern and fractal. The phenomenon observed in nature viz., Physical, Chemical and Biological. Case studies and Applications. The diversity and commonality of cells, protein structure and function, basic molecular genetic mechanisms, bio membranes and cell architecture, transport of ions and small molecules across Cell membranes, cellular energetics, cell birth, lineage and death. **Self Study:** Physiological activities. | | |
| **UNIT 2** | **Applications of Biology** | **7 HOURS** |
| Physiologic Systems - An Outline of Cardiovascular Structure and Function, Endocrine System, Nervous System, Vision System, Defense mechanisms in plants and animals. Introduction to Bio Sensors, Performance Factors, Factors Affecting the Performance of Sensors, Areas of Application. Biological Sensing Elements, Biological transducers. Discovery and Innovations in applications of Biology. **Self Study:** Locomotion. | | |
| **UNIT 3** | **The Role of Chemistry for Engineers** | **8 HOURS** |

**Applications/Case Study:** Hydrogen Spectrum.

(A) **Introduction:** This section is an introduction to chemistry and chemical methods for engineering students. It describes how chemistry is used in engineering and how chemical principles aid engineers in the choice of materials for a particular application. Principles of Green chemistry are reviewed. The classification of separation methods used for mixtures. (B) **Periodic Table:** This section covers the names and symbols of the elements. The basic structure of the atom is reviewed including an explanation of isotopes. A discussion of the atomic structure describes electronic shells, subshells, their quantum numbers, orbital shapes, electron filling order, and the determination of the complete electron configuration of the elements. General description of the modern periodic table. Correlation between the valence electron configurations and the chemical properties of the elements. The periodic trends according to the position of the elements in the periodic table.

**Self Study:** Slater's rule for ion.

| UNIT 4 | Chemical Bonding - The Formation of Materials | 9 HOURS |
|---|---|---|

(A) **The Formation of Materials:** This section covers chemical bonding and its effect on the chemical properties of the elements. Ionic bonding & covalent bonding are compared in terms of the octet rule and valence bond theory. Polar and non-polar covalent bonds. Molecular orbital theory is introduced to explain magnetism, bond order and hybridization helpful in Carbon chemistry. Intermolecular forces, including hydrogen bonding, are discussed with a special Case Study focusing on the special properties of water.

(B) **Engineering Materials:** This section covers the Resources of Natural Materials, Introduction to Material Sciences viz. Polymers, Specialty polymers, Biomaterials, Nano materials and Smart materials with their examples and applications.

**Self Study:** Real life applications of smart materials.

| UNIT 5 | Chemical Analysis and Instrumentation | 7 HOURS |
|---|---|---|

This chapter covers some of the more common instrumental methods used for the qualitative and quantitative analysis of materials. The principles of chromatography are introduced with paper chro- matography and later applied to thin layer chromatography, pH-metry and Conductometry are reviewed as a few important and basic methods for analysis of chemical compounds and a case study on the analysis of water samples is given as an example. UV-visible absorption spectroscopy is reviewed as one of the sophisticated analytical techniques.

**Self Study:** Applications in Bio-medical field.

| UNIT 6 | Water Treatment and Effluent Management | 6 HOURS |
|---|---|---|

**Applications/Case Study:** Water analysis of river Indrayani.
This chapter covers types of impurities in water & the conventional water treatment methods. Hard- ness, Alkalinity and Chloride content of water, its causes, types and volumetric methods for their de- terminations are reviewed along with numerical. Various water softening & treatment methods which includes filtration methods by Carbon adsorption, ion-exchange methods and membrane techniques are explained.

**TEXT BOOKS**

Jain, P. C., & Jain, M. (1998). Engineering Chemistry: Chemistry of Engineering Materials. Dhanpat Rai Pub. Com.

Khopkar, S. M. (2008). Basic of Concept of Analytical Chemistry; 3 rd Edn; New AGF Interna- tional Pvt. Ltd. Publisher, New Delhi, 1-5.

Chauhan, B. S. (2008). Engineering Chemistry. Laxmi Publications, Ltd..

Lodish, H., Berk, A., Kaiser, C. A., Kaiser, C., Krieger, M., Scott, M. P., ... & Matsudaira, P. (2008). Molecular cell biology. Macmillan.

**REFERENCE BOOKS**

Gaffney, J., & Marley, N. (2017). General chemistry for engineers. Elsevier.

Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2013). Fundamentals of analytical chemistry. Cengage learning.

Willard, H. H., Merritt Jr, L. L., Dean, J. A., & Settle Jr, F. A. (1988). Instrumental methods of analysis.

Pradeep, T. (2012). Textbook of nanoscience and nanotechnology. McGraw-Hill

**E-RESOURCES**

1. https://www.youtube.com/playlist?list=PLQz881uBQ2VolnNFyTQVpy4YVqUfnbvUw

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF CHEMICAL ENGINEERING | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Science of Nature Lab |
| | COURSE CODE | 2301104L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2301104L.CEO.1: To provide students with knowledge of purification and separation methods to evaluate their significance and applications in engineering.

2301104L.CEO.2: To enable students to understand chemical bonding and material science principles for assessing material properties and applications in engineering.

2301104L.CEO.3: To introduce students to basic principles and instrumentation techniques for per- forming and interpreting engineering-related analytical procedures.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301104L.CO.1: Utilize the knowledge of purification and separation techniques to evaluate their significance and application in engineering contexts [L3].

2301104L.CO.2: Implement chemical bonding theories and engineering material principles to assess the formation and properties of materials for their practical use in engineering solutions [L3].

2301104L.CO.3: Employ the basic principles and instrumentation techniques to perform and interpret analytical techniques relevant to engineering [L3].

| | | |
|---|---|---|
| **PRACTICALS:** Any 8 Experiments will be conducted. | | |
| **PRACTICAL NO.01** | **Distillation** | **2 HOURS** |
| Separation of two miscible liquids using distillation process. | | |
| **PRACTICAL NO.02** | **Polymerization** | **2 HOURS** |
| Synthesis by condensation polymerization reaction. | | |
| **PRACTICAL NO.03** | **Nano Particle** | **4 HOURS** |
| Synthesis of nano particles using reduction method. | | |
| **PRACTICAL NO.04** | **pH Metry** | **4 HOURS** |
| Determination of the dissociation constant of a weak acid using pH meter. | | |
| **PRACTICAL NO.05** | **Paper Chromatography** | **2 HOURS** |
| Separation of inorganic cations by paper chromatography. | | |
| **PRACTICAL NO.06** | **TLC** | **2 HOURS** |
| Separation of organic compounds by TLC. | | |
| **PRACTICAL NO.07** | **Conductometry** | **4 HOURS** |
| Conductometric titration for mixture of acids. | | |
| **PRACTICAL NO.08** | **Colorimetry / Spectrophotometry** | **2 HOURS** |
| Absorption studies. | | |
| **PRACTICAL NO.09** | **Hardness of Water** | **4 HOURS** |
| Determination of Hardness of water by EDTA method. | | |
| **PRACTICAL NO.10** | **Alkalinity** | **2 HOURS** |
| Determination of alkalinity of water by neutralization titration. | | |
| **PRACTICAL NO.11** | **Adsorption Studies** | **2 HOURS** |
| Water purification by activated charcoal. | | |
| **PRACTICAL NO.12** | **Physical Phenomenon** | **2 HOURS** |
| Case Studies of Physical Phenomenon | | |
| **PRACTICAL NO.13** | **Chemical Phenomenon** | **2 HOURS** |
| Case Studies of Chemical Phenomenon | | |
| **PRACTICAL NO.14** | **Biological Phenomenon** | **2 HOURS** |
| Case Studies of Biological Phenomenon | | |

**TEXT BOOKS**

Jain, P. C., & Jain, M. (1998). Engineering Chemistry: Chemistry of Engineering Materials. Dhanpat Rai Pub. Com.

Khopkar, S. M. (2008). Basic of Concept of Analytical Chemistry; 3 rd Edn; New AGF Interna- tional Pvt. Ltd. Publisher, New Delhi, 1-5.

Chauhan, B. S. (2008). Engineering Chemistry. Laxmi Publications, Ltd..

Lodish, H., Berk, A., Kaiser, C. A., Kaiser, C., Krieger, M., Scott, M. P., ... & Matsudaira, P. (2008). Molecular cell biology. Macmillan.

**REFERENCE BOOKS**

Gaffney, J., & Marley, N. (2017). General chemistry for engineers. Elsevier.

Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2013). Fundamentals of analytical chemistry. Cengage learning.

Willard, H. H., Merritt Jr, L. L., Dean, J. A., & Settle Jr, F. A. (1988). Instrumental methods of analysis.

Pradeep, T. (2012). Textbook of nanoscience and nanotechnology. McGraw-Hill

**E-RESOURCES**

1. https://www.youtube.com/playlist?list=PLQz881uBQ2VolnNFyTQVpy4YVqUfnbvUw

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Foundation of Computing |
| | COURSE CODE | 2304101T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** Basics of Computer and Mathematics

**COURSE OBJECTIVES :**

2304101T.CEO.1: Enhance problem solving abilities of students.

2304101T.CEO.2: Develop a logic to efficiently use the programming constructs to solve the computing problems.

2304101T.CEO.3: Encourage the test driven coding approach.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304101T.CO.1: Design a solution to the problem by applying appropriate logic to get the desired results.[L3]

2304101T.CO.2: Design an algorithm and flowchart for the problem using traditional and tool-based approaches.[L3]

2304101T.CO.3: Solve the real world problems by multiple programming solutions.[L3]

**COURSE ABSTRACT:**

The Course emphasizes logic building and problem-solving abilities to write efficient algorithms and understanding how to debug and test C programs. C is the best programming language to start learning in computer programming. The significance of the C programming language is that it is recognized world- wide and used in many of the applications, including advanced scientific systems and operating systems. The C language provides the base language of all advanced computer languages. Course contains basic elements of C programming,data types, operators, Control Structures, conditional statements, looping , arrays, string operations, functions, pointers,user defined data types-structure and union.

**THEORY COURSE CONTENTS**

| UNIT 1 | FUNDAMENTALS OF C | 04 HOURS |
|---|---|---|

**Applications/Case Study:** Introduction to SCRATCH tool, Gaming applications, calculator appli- cation

**Contents:** Introduction to programming, why to learn programming, programming for everybody, Overview of C, Character set, Constants, Variables and Keywords, Data types, Operators - arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise op- erators, assignment operator, Expressions-Type Conversion, precedence and order of evaluation

**Self Study:** Using conditions and loops on SCRATCH

| UNIT 2 | CONTROL STRUCTURES | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Ticket Booking App, online shopping site

**Contents:** Decision Control Structure-If statement, if-else statement, Nested if-else statement, Ternary operator, Case Control structure- Switch Case Statements, GOTO statement, Loop Control Structure- while statement, do while statement, for statement, odd loop, nesting of loops, break and continue statement, finite and infinite Loop

**Self Study:**Prepare Algorithm and Flowchart for the control statements above

| UNIT 3 | ARRAYS, STRINGS, FUNCTIONS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Leader Board of a game, Spell Checkers,Search Engine

**Contents:** Array Declaration and Initialization, Bounds Checking, Array arithmetic, One dimensional arrays and multi-dimensional Arrays, Strings - Standard Library String Functions, Array of strings, String operations, Functions, procedures, Difference between functions and procedures, Function defi- nition and prototype, Scope Rule of Functions, Calling Conventions, Passing Values between Functions

- Call by Values, Recursive functions, Passing Array Elements to a Function

**Self Study:** How to pass 2D array as a function parameter, Variable Length Arrays (VLAs) in C

| UNIT 4 | POINTERS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Dynamic Memory Allocation, Implementation of Data Structures
**Contents:** Pointers and Addresses, Pointer Notation and Arithmetic, Pointer to an array, Array of pointers, Pointer to a function, Passing pointers as function arguments, function call by reference, difference between call by value and call by reference, Strings and Pointers, Structures and Pointers **Self Study:** Pointer to Pointer (Double Pointer), Chain of Pointers in C

| UNIT 5 | USER DEFINED DATA TYPES | 04 HOURS |
|---|---|---|

**Applications/Case Study:** Memory management, Database Management

**Contents:** Structures and Union: Declaration of Structure and Union, Difference between Structure and Union, Accessing Structure Elements, How Structure Elements are Stored, Array of Structures **Self Study:** Anonymous Union and Structure in C, Enumeration (enum) in C

**Further Readings:** User Defined Data Type- class in CPP

**TEXT BOOKS**


E. Balguruswamy , "Computing Fundamentals and C Programming" , Tata Mc-Graw Hill, ISBN 13: 978-0-07-066909-3

Balagurusamy, E. (2016). Programming In Ansi C.

Kanetkar, Y. (2018). Let us C. BPB publications.

Yashavant, K. (2020). Let us C. BPB Publications.

Kernighan, B. W., & Ritchie, D. M. (2002). The C programming language.

GHOSH, S. (2008). All of C. PHI Learning Pvt. Ltd.


**REFERENCE BOOKS**


Hanly, J. R., & Koffman, E. B. (2007). Problem solving and program design in C. Pearson Education India.

Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, Oxford University Press, ISBN 13 978-0-19-806528-9

S. Thamrai Selvi, R Murugesan, "Test your skills in C", Tata Mcgraw Hill, ISBN13:978-0-07- 044759-2

Yashvant Kanitkar, "C Projects", BPB Publication, 2nd Edition, ISBN 81-7029-256-5

R.G. Dromey , "How to solve it by Computer", Prentice Hall, ISBN -13. 978-0134340012

Byron S. Gottfried, Jitender Kumar Chhabra, "Programming with C", Tata Mcgraw Hill, ISBN13:978-0- 07-059369-5

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Foundations of Computing Lab |
| | COURSE CODE | 2304101L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 02 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Basics of Computer and Mathematics

**COURSE OBJECTIVES :**

2304101L.CEO.1: Facilitate the building of programming solutions using the appropriate programming constructs.

2304101L.CEO.2: Encourage logical thinking to find alternate programming solution for the given problem.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304101L.CO.1: Make use of appropriate programming constructs to solve real world problems. [L3]

2304101L.CO.2: Build modular, reusable code using functions, recursions and standard library functions. [L3]

2304101L.CO.3: Build a programming solution with suitable logic to get the required output.[L3]

**COURSE ABSTRACT:**

The Foundation of Computing Lab is a hands-on course designed to complement the theoretical knowl- edge of C programming with practical experience. This lab course aims to develop a deep understanding of the C language through a series of lab assignments, home assignments and real-world problem-solving scenarios. Students will learn the fundamentals of programming in C, including data types, control struc- tures, functions, arrays, pointers.Emphasis is placed on writing optimized, readable, and error-free code via test driven approach.

**PRACTICALS**

| **PRACTICAL NO.01** | **Fundamentals of C** | **4 HOURS** |
|---|---|---|

**Practice Problem Statements:**

1. Write a menu driven program in C to display addition, subtraction, multiplication, division of two numbers
2. Write a program in C to display the quotient and remainder after the division of two numbers
3. Write a program to evaluate any mathematical expression and observe the operator precedence
4. Write a program in C to demonstrate the use of left shift, right shift, and, or, xor operators

**Assignment:**

1. Write a program in C to demonstrate logical and relational operators

| **PRACTICAL NO.02** | **Control Structures** | **6 HOURS** |
|---|---|---|

**Practice Problem Statements:**

1. Write a program in C to display the grade obtained by the student in a course. The input will be the marks obtained and the output will be the grade obtained
2. Write a program in C to display first N numbers on the screen using while, do while and for loop
3. Write a program in C to display first N number in reverse order on the screen using while, do while and for loop
4. Write a program in C display various patterns using ( Any two Patterns)
5. Get the information of lengths of sides and angles of triangle and print the type of triangle whether it is equilateral, isosceles or scalene, right, acute or obtuse.

**Assignment:**

1. Prepare a grocery bill after applying 5% discount for new customer and 10% discount for regular customer

| PRACTICAL NO.03 | Arrays, Strings and Functions | 8 HOURS |
|---|---|---|

**Practice Problem Statements:**

1. Write a program in C to perform matrix addition
2. Write a program in C to implement linear search and binary search algorithms for a numeric array
3. Write a program in C to convert every lowercase letter to uppercase letter and vice versa
4. Write a program in C to implement the string functions using the standard library functions supported by string.h like: string length, string copy, string reverse, string concatenate, string compare, sub string
5. Write a program in C to perform matrix multiplication
6. Take three different arrays to store numbers divisible by 2, 3 and 5 respectively. Get 20 numbers as input and place them in appropriate array
7. Write a C function to find simple interest. Pass input values as parameters
8. Write a program in C using recursion to display the Fibonacci sequence for a given range

**Assignment:**

1. Write a menu driven program in C using functions to implement the following string operations without using the standard library functions, string concatenate, string compare, string palin- drome

| PRACTICAL NO.04 | Pointers | 8 HOURS |
|---|---|---|

**Practice Problem Statements:**

1. Write a program to differentiate between pointer to an integer and pointer to an array of integers
2. Write a program to print addresses of array elements using pointers
3. Write a C function to swap values of two variables using call by reference
4. Write a program to store and access string using pointer to string
5. Print numbers within given range by passing the function pointer as a parameter
6. Demonstrate working of circular linked list using pointers

| PRACTICAL NO.05 | User Defined Data Types | 2 HOURS |
|---|---|---|

**Practice Problem Statements:**

1. Write a program in C to accept the information of five students and store it in structure and display the same
2. Write a C program using structure to store employee data (Name and salary) , then display name of the manager who is having highest salary, and obtain total expenditure of company on employee's salary

**Assignment(Any one):**

1. Use structure and pointers to maintain Olympic game's data. Store the information of medals won by several countries. Depending upon the types of medals won by the respective country give the rank
2. Use structure and pointers to maintain books data. Depending upon the number of readers of a book measure the popularity of that book

| PRACTICAL NO.06 | Competitive Coding | 4 HOURS |
|---|---|---|

Solve scenario based real world problems by developing a solution in series of steps such as designing algorithms, data structures, coding/programming and testing.
Note: Practice Multiple Problems

**TEXT BOOKS**


E. Balguruswamy , "Computing Fundamentals and C Programming" , Tata Mc-Graw Hill, ISBN 13: 978-0-07-066909-3

Balagurusamy, E. (2016). Programming In Ansi C.

Kanetkar, Y. (2018). Let us C. BPB publications.

Yashavant, K. (2020). Let us C. BPB Publications.

Kernighan, B. W., & Ritchie, D. M. (2002). The C programming language.

GHOSH, S. (2008). All of C. PHI Learning Pvt. Ltd.

**REFERENCE BOOKS**

Hanly, J. R., & Koffman, E. B. (2007). Problem solving and program design in C. Pearson Education India.

Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, Oxford University Press, ISBN 13 978-0-19-806528-9

S. Thamrai Selvi, R Murugesan, "Test your skills in C", Tata Mcgraw Hill, ISBN13:978-0-07- 044759-2

Yashvant Kanitkar, "C Projects", BPB Publication, 2nd Edition, ISBN 81-7029-256-5

R.G. Dromey , "How to solve it by Computer", Prentice Hall, ISBN -13. 978-0134340012

Byron S. Gottfried, Jitender Kumar Chhabra, "Programming with C", Tata Mcgraw Hill, ISBN13:978-0- 07-059369-5

**E-RESOURCES**

https://nptel.ac.in/courses/106105171

https://www.geeksforgeeks.org/c-programming-language/

https://www.w3schools.com/c/

https://www.codechef.com/ide

https://scratch.mit.edu/

https://www.youtube.com/@bhagyashreealhat4824/videos

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF CIVIL ENGINEERING | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Applied Mechanics |
| | COURSE CODE | 2303101T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2303101T.CEO.1: To define fundamental concepts and laws of rigid body mechanics.
2303101T.CEO.2: To state conditions of equilibrium for engineering structures.
2303101T.CEO.3: To describe kinematic parameters of rectilinear and curvilinear motion. 2303101T.CEO.4: To explain energy and momentum methods of kinetics"

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2303101T.CO.1: Determine the resultant of system of forces acting on bodies. [L1]
2303101T.CO.2: Calculate the support reactions and member forces for simple structures. [L2]
2303101T.CO.3: Analyse bodies in rectilinear and curvilinear motion. [L4]
2303101T.CO.4: Apply energy and momentum methods for kinetics problems. [L3]

**COURSE ABSTRACT**

This course is built on the foundation and framework of mathematics and physics. The course requires students to have strong abstract thinking and reasoning skills. In addition, Concepts will be applied in this course from previous courses you have taken in basic math and physics. The course addresses the modeling and analysis of real world engineering applications and problem solving. In this course, we shall be learning about interaction between bodies dealing with STATICS and in the second part DYNAMICS students will study the motion of particles. Statics covers free body diagrams, equilibrium of rigid bodies, analysis of trusses and beams, discussion on friction, virtual work and stability. Dynamics deals with general plane motion of rigid bodies, use of translating and rotating motion frames of reference for analysis, plane kinetics and work energy principle.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Basics of Statics** | **7 HOURS** |

**Applications/Case Study:** Failure of any building, bridge etc.

**Contents:** Fundamental Concepts and Principles in mechanics, Force and force systems, Resolution, Resultant, and Moment of a force system; Equilibrium of a particle systems. Free body diagram (FBD). Equilibrium of rigid bodies.

**Self Study:** Observe the static objects around you and draw free body diagram and calculate resultant

of same.

| | | |
|---|---|---|
| **UNIT 2** | **Applications of Statics** | **8 HOURS** |

**Applications/Case Study:** Determination of axial forces for industrial truss.

**Contents:** Types of supports and their reactions. Beam reactions, Analysis of cables, Analysis of trusses, and Analysis of frames. Centroid of plane laminas. Engineering applications of friction. Belt Friction, Wedge friction.

**Self Study:** Understanding following questions are expected from the students.

1. What does it mean for a design of members to be ”Statically indeterminable”?
2. What is a ”Two force Member”?
3. Which forces are allowed on a member?

| | | |
|---|---|---|
| **UNIT 3** | **Kinematics of particle** | **8 HOURS** |

**Applications/Case Study:** Falling Body and Projectile Motion Case Study.

**Contents:** Basic concepts in kinematics- Position, velocity, acceleration, jerk. Rectilinear motion with constant and variable acceleration. Connected body motions. Relative motion. Curvilinear motion in Cartesian coordinates and path coordinates.

**Self Study:** Study of gyroscopic motion.

| UNIT 4 | Kinetics of particle | 7 HOURS |
|---|---|---|

**Contents:** Kinetics- Equation of motion. Concept of work done, energy and power. Principle of work and energy. Conservation of energy. Principle of impulse and momentum. Conservation of momentum. Collisions- Direct central impact. Coefficient of restitution.
**Self Study:** Study of vehicle dynamics.

**TEXT BOOKS**

Nelason, A. (2009). Engineering Mechanics: Statics and Dynamics. 2nd Edition, Tata McGraw- Hill Education.

Anil Kumar D. (2015). Engineering Mechanics: Statics Dynamics", 1st edition, Tata McGraw-

**REFERENCE BOOKS**

1. Hibbeler, R. C. (2009). Gupta Ashok Engineering Mechanics: Statics Dynamics.", 14th Edition, Pearson Education Inc., Prentice Hall.

**E-RESOURCES**

1. https://archive.nptel.ac.in/courses/112/106/112106286/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF CIVIL ENGINEERING | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Applied Mechanics Lab |
| | COURSE CODE | 2303101L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2303101L.CEO.1: To provide students with hands-on experience and practical knowledge in the field of applied mechanics.
2303101L.CEO.2: To bridge the gap between theoretical concepts learned in the classroom and real- world applications.
2303101L.CEO.3: To develop a deep understanding of fundamental mechanics principles and their practical implications.through a combination of experiments and projects,"

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2303101L.CO.1: Develop a practical understanding of fundamental mechanics principles and apply theoretical knowledge to solve real-world engineering problems [L3].
2303101L.CO.2: Analyze, and interpret experimental data, and present results in a clear and organized manner [L4].
2303101L.CO.3: Design, conduct, and analyze experiments by effective collbrating with team members [L6].
2303101L.CO.4: Build ethical behavior in conducting experiments, handling data, and interacting with colleagues [L3]. "

| PRACTICALS/ACTIVITIES | | |
|---|---|---|
| **PRACTICAL NO.01** | **Parallelogram Law** | **2 HOURS** |
| To verify parallelogram law of force addition. | | |
| **PRACTICAL NO.02** | **Law of moments** | **2 HOURS** |
| To verify law of moments for parallel forces. | | |
| **PRACTICAL NO.03** | **Block Friction** | **2 HOURS** |
| To determine coefficient of static friction for a block on a plane. | | |
| **ACTIVITY NO.01** | **Truss model** | **2 HOURS** |
| To develop truss model. | | |
| **PRACTICAL NO.04** | **Belt Friction** | **2 HOURS** |
| To determine coefficient of static friction for a flat belt on a drum. | | |
| **PRACTICAL NO.05** | **Centroid 1D** | **2 HOURS** |
| To determine centroid of composite wire object. | | |
| **PRACTICAL NO.06** | **Centroid 2D** | **2 HOURS** |
| To determine centroid of composite plane lamina. | | |
| **ACTIVITY NO.02** | **Model making for Centroid** | **2 HOURS** |
| To develop the model for centroid. | | |
| **PRACTICAL NO.07** | **Projectile Motion** | **2 HOURS** |
| To analyze projectile motion in Cartesian coordinates. | | |
| **ACTIVITY NO.03** | **Model making for Projectile** | **2 HOURS** |
| To develop the model for projectile. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.08** | **Compound Pendulum** | **2 HOURS** |
| To determine mass moment of Inertia of compound pendulum. | | |
| **PRACTICAL NO.09** | **Fly Wheel** | **2 HOURS** |
| To analyse rotational motion of a flywheel about a fixed axis. | | |
| **ACTIVITY NO.04** | **Model of parachute** | **2 HOURS** |
| To develop the parachute model. | | |
| **PRACTICAL NO.10** | **Direct Central Impact** | **2 HOURS** |

| To determine coefficient of restitution for direct central impact. | | |
|---|---|---|
| **PRACTICAL NO.11** | **Final Exam** | **2 HOURS** |
| For all batches during the lab hours. | | |

**TEXT BOOKS**

1. Meriam, J. L., Kraige, L. G., & Bolton, J. N. (2020). Engineering mechanics: dynamics. John Wiley & Sons.

**REFERENCE BOOKS**

1. NIL

**E-RESOURCES**

1. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF MECHANICAL ENGINEERING | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Design Thinking |
| | COURSE CODE | 2309101T |
| | COURSE CREDITS | 1 |
| RELEASED DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2309101T.CEO.1: To utilize information collection tools to clearly define user centric problem.
2309101T.CEO.2: To apply SCAMPER tool to find diverse solutions.
2309101T.CEO.3: To choose one concept out of the selected alternatives by taking into consideration user centred design parameters.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2309101T.CO.1: Apply Design Thinking principle to user centric problem [L3].
2309101T.CO.2: Select different design thinking tools to solve real world problem [L3].
2309101T.CO.3: List appropriate prototyping technique to build a solution [L4].

**COURSE ABSTRACT**

Design thinking is a powerful process of problem solving as it deals with human centred design approach. When design thinking approaches are applied to business, the success rate for innovation improves substantially. The course aim to imbibe understanding of the design thinking process and apply it to real- world problems while building their strong teamwork and communication skills. Students will learn to use the design thinking process to solve complex problems and create innovative solutions. Course covers topics such as research, ideation, prototyping, testing, and iteration. Students also learn to use a variety of design thinking tools, such as personas, journey maps, mind mapping, SWOT analysis, SCAMPER, Brainstorming, AEIOU framework etc. Students work in team to tackle real-world design challenges. So they learn how to communicate their ideas effectively and how to receive and give constructive feedback and present their design solutions in aclear and compelling manner. Upon completion of the course, students will have a deep understanding of the design thinking process and how to apply it to real- world problems. They will be able to use a variety of design thinking tools and techniques to generate and evaluate ideas, create prototypes, and test and refine their solutions. They will also have strong teamwork and communication skills, making them valuable members of any design team.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **FUNDAMENTALS OF DESIGN THINKING** | **2 HOURS** |
| Introduction to design, types of design, Introduction to Design Thinking, Divergent Thinking, Conver- gent Thinking.<br>Various types of thinking: Critical thinking, Creative thinking, lateral thinking, Disruptive Thinking.<br>**Self Study:** Timeline. | | |
| **UNIT 2** | **HUMAN CENTRED DESIGN** | **2 HOURS** |
| Introduction to Human Centred Design, Human Centred Design Phases, Human Centred Design Pro- cess, Human Centred Design case study, Planet centric Design.<br>**Self Study:** Customer Journey Map. | | |
| **UNIT 3** | **ANTHROPOLOGY** | **2 HOURS** |
| Characteristics of Anthropology: Culture, holistic approach, field work, multiple theories and purposes of anthropology. Empathy and Ethnography.<br>**Self Study-** Ethnograpy: AEIOU Framework. | | |
| **UNIT 4** | **DESIGN THINKING TOOLS** | **3 HOURS** |
| Empathy stage tools : User Research Tools (Interviews: Conducting one-on-one or group interviews to get deep insights into user behavior and needs, Surveys & Questionnaires, Ethnographic Studies, Observation), Empathy Map, Personas Define stage tools: Problem Statement/Point of View (POV), Affinity Diagrams, Journey Mapping Ideate Stage Tools: Brainstorming, Mind Mapping, SCAMPER Prototype Stage Tools: Low-Fidelity Prototypes, High-Fidelity Prototypes, Storyboarding, Wizard of Oz Prototyping<br>**Self Study:** Likert Scale, Affinity Diagram, Reverse engineering of a research paper to identify all the | | |

| |
|---|
| essential elements of the research. |

| UNIT 5 | IDEATION | 4 HOURS |
|---|---|---|
| SWOT analysis, Vein Diagram (User Desirability, Feasibility, Viability check) Drawing inferences, Translation of inferences into design criteria, specific problem statement, Ideation – free hand sketch- ing drawing of simple form of products (Isometric views, layout, circuit diagram, Ideation sketches), Ergonomic and aesthetic consideration in design.<br>**Case Study:** SCAMPER, TRIZ. | | |
| **UNIT 6** | **PROTOTYPING** | **2 HOURS** |
| Concept validation, evaluation and detailing, Different methods of Prototyping, selection of right method of prototyping.<br>**Case Study:** Minimum Viable Product. | | |

**TEXT BOOKS**


Yayici, E. (2016). Design thinking methodology book. ArtBizTech.

Mootee, I. (2013). Design thinking for strategic innovation: What they can't teach you at business or design school. John Wiley & Sons.

Lockwood, T. (2010). Design thinking: Integrating innovation, customer experience, and brand value. Simon and Schuster.

Marc, S. (2012). This is Service Design Thinking: Basics-Tools-Cases. Bis Publishers.


**REFERENCE BOOKS**


Jones, J. C. (1992). Design methods. John Wiley & Sons.

Cross, N. (2011). Design thinking: Understanding how designers think and work. Berg.

Gonen, E. (2020). Tim brown, change by design: how design thinking transforms organizations and inspires innovation (2009). Markets, Globalization & Development Review, 4(2).

Melles, G., de Vere, I., & Misic, V. (2011). Socially responsible design: thinking beyond the triple bottom line to socially responsive and sustainable product design. CoDesign, 7(3-4), 143-154.

Kumar, V. (2012). 101 design methods: A structured approach for driving innovation in your organization. John Wiley & Sons.

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF MECHANICAL ENGINEERING | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Design Thinking Lab |
| | COURSE CODE | 2309101L |
| | COURSE CREDITS | 1 |
| RELEASED DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 20 | 40 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2309101L.CEO.1: To apply ethnographic framework to carryout design thinking project.
2309101L.CEO.2: To build prototype of alternative based on human centred design.
2309101L.CEO.3: To present design thinking project.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2309101L.CO.1: To apply ethnographic framework to define design thinking project [L3].
2309101L.CO.2: Identify the specific problem of target user [L3].
2309101L.CO.3: Develop multiple solution for the identified problem [L3]. 2309101L.CO.4: Build the prototype of the best fitted solution [L3].
2309101L.CO.5: Conduct test for validation of the best fitted solution [L4].

**COURSE ABSTRACT**

In Design thinking lab students will carry out all the steps involved in design thinking practically. The steps involved are empathy, problem definition, ideation, prototyping and testing. Students will engage in observing and understanding user needs within a specific domain. They will carry out primary and secondary research to gather relevant data and insights (empathy map and problem definition). This research will help students to define the specifications and requirements for the product. Using SCAMPER tool students will generate innovative ideas based on the identified needs and specifications (ideation). Evaluation of concepts will be carried out by using Pugh matrix and the concept which is having more weightage will be selected for creating a prototype (concept evaluation and testing). Using this prototype student will validate the solution by taking feedback from user(testing). In summary student will apply the tools taught during theory class to carry out their design thinking project.

| **PRACTICALS:(Project Work)** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Needs Finding (Observation of Domain)<br>**Self Study:** space Interaction. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Research methodology | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Product Specification<br>**Self Study:** RUTAG Project Exploration. | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Ideation | | |
| **PRACTICAL NO.05** | | **4 HOURS** |
| Concept Evaluation, Validation and Concept detailing<br>**Self Study:** Pugh Matrix. | | |
| **PRACTICAL NO.06** | | **6 HOURS** |
| Prototyping | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Documentation | | |

**TEXT BOOKS**

Yayici, E. (2016). Design thinking methodology book. ArtBizTech.

Mootee, I. (2013). Design thinking for strategic innovation: What they can't teach you at business or design school. John Wiley & Sons.

Lockwood, T. (2010). Design thinking: Integrating innovation, customer experience, and brand value. Simon and Schuster.

Marc, S. (2012). This is Service Design Thinking: Basics-Tools-Cases. Bis Publishers.

**REFERENCE BOOKS**

Jones, J. C. (1992). Design methods. John Wiley & Sons.

Cross, N. (2011). Design thinking: Understanding how designers think and work. Berg.

Gonen, E. (2020). Tim brown, change by design: how design thinking transforms organizations and inspires innovation (2009). Markets, Globalization & Development Review, 4(2).

Melles, G., de Vere, I., & Misic, V. (2011). Socially responsible design: thinking beyond the triple bottom line to socially responsive and sustainable product design. CoDesign, 7(3-4), 143-154.

Kumar, V. (2012). 101 design methods: A structured approach for driving innovation in your organization. John Wiley & Sons.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Data Driven Modeling |
| | COURSE CODE | 2311161T |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

**PREREQUISITE KNOWLEDGE :** NIL

**COURSE OBJECTIVES :**

2311161T.CEO.1: Understand the need of data modeling. 2311161T.CEO.2: Learn different types of data modeling. 2311161T.CEO.3: Analyzing data for better decision making. 2311161T.CEO.4: Optimize the querying for effective data analysis.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311161T.CO.1: Able to make a Dimensional table with facts and measures. [L3]. 2311161T.CO.2: Select correct dimensional model for the given case study [L4].

2311161T.CO.3: Apply Data definition, control and manipulation queries on given data [L3]. 2311161T.CO.4: Use joins and subqueries for data analysis [L3].

**COURSE ABSTRACT:**

This course is designed to give a primer in the fundamentals of data modeling and querying techniques for better decision making. Effective use of SQL and working with data for data driven decision making. As data driven decision making is a need of hour, it is important to learn how to use and apply the powerful language of SQL to better communicate and extract data from databases in the data science field. Acquiring skills of SQL for Data Science is one of the fastest ways to improve the career prospects of the students as it is one of the most in-demand tech skills! This course will imbibe basic to moderate analysis techniques using querying methods. This course will teach students to ask the right questions and come up with good answers to deliver valuable insights for the organization. This course starts with the basics and assumes students do not have any knowledge or skills in data modeling and SQL. It will build on that foundation and gradually make students competent to write both simple and complex queries to gain better insights.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION** | **06 HOURS** |
| **Applications/Case Study:** NIL<br>**Contents:** Introduction to data management, different types of data management schemes, Relational data management , Significance of data management. Concepts of primary and foreign keys.<br>**Self Study:** Properties of good database<br>**Further Readings:** Relational key mappings | | |
| **UNIT 2** | **DATA MODELING** | **05 HOURS** |
| **Applications/Case Study:** NIL<br>**Contents:** Need for data modeling, Different types of modeling techniques, case study for making start, snowflake and fact constellation modeling.<br>**Self Study:** Facts and Dimensions<br>**Further Readings:** Types of different dimensions and facts and it's significance | | |
| **UNIT 3** | **BASICS OF SQL** | **04 HOURS** |
| **Applications/Case Study:** NIL<br>**Contents:** Study of different Analyzing, transforming and summarizing methods using SQL queries.<br>**Self Study:** Different Domain Databases<br>**Further Readings:** Varrays and Object Oriented SQL | | |

**TEXT BOOKS**

Allen G. Taylor. (2019). *SQL All - In - One For Dummies*. 3rd Edition, Wiley. ISBN 978- 8126534494.

Berg Craig. (2019). *SQL For Beginners: SQL Made Easy; A Step-By-Step Guide to SQL Pro- gramming for the Beginner, Intermediate and Advanced User (Including Projects and Exercises)*. 1st Edition, Antony Mwau. ISBN 978-1951737252.

Jiawei Han, Micheline Kamber, Jian Pei. (2022). *Data Mining: Concepts and Techniques*. 4th Edition, Elsevier Standard. ISBN 978-8131267660.

**REFERENCE BOOKS**

braham Silberschatz, Henry F. Korth, S. Sudarshan. (2021). *Database System Concepts* . 7th Edition, McGraw-Hill Education. ISBN 978-9390727506.

Paulraj Ponniah (2012). *Data Warehousing: Fundamentals for IT Professionals*. 2nd Edition, Paperback, McGraw Hill Publishers. ISBN 978-0073523323.

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| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Data Driven Modeling Lab |
| | COURSE CODE | 2311161L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 20 | 40 |

**PREREQUISITE KNOWLEDGE :** NIL

**COURSE OBJECTIVES :**

2311161L.CEO.1: Understand the need of data modeling. 2311161L.CEO.2: Learn different types of data modeling. 2311161L.CEO.3: Analyzing data for better decision making. 2311161L.CEO.4: Optimize the querying for effective data analysis.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311161L.CO.1: Able to make a Dimensional table with facts and measures. [L3]. 2311161L.CO.2: Select correct dimensional model for the given case study [L4].

2311161L.CO.3: Apply Data definition, control and manipulation queries on given data [L3]. 2311161L.CO.4: Use joins and subqueries for data analysis [L3].

**COURSE ABSTRACT:**

This course is designed to give a primer in the fundamentals of data modeling and querying techniques for better decision making. Effective use of SQL and working with data for data driven decision making. As data driven decision making is a need of hour, it is important to learn how to use and apply the powerful language of SQL to better communicate and extract data from databases in the data science field. Acquiring skills of SQL for Data Science is one of the fastest ways to improve the career prospects of the students as it is one of the most in-demand tech skills! This course will imbibe basic to moderate analysis techniques using querying methods. This course will teach students to ask the right questions and come up with good answers to deliver valuable insights for the organization. This course starts with the basics and assumes students do not have any knowledge or skills in data modeling and SQL. It will build on that foundation and gradually make students competent to write both simple and complex queries to gain better insights.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **06 HOURS** |
| Dimensional model creation for given case study using DDL Queries with all constraints. | | |
| **PRACTICAL NO.02** | | **06 HOURS** |
| Data control, summarization and analysis using queries for given data model | | |
| **PRACTICAL NO.03** | | **06 HOURS** |
| User management, filtering and aggregation operations on given data model. | | |
| **PRACTICAL NO.04** | | **06 HOURS** |
| Performing joins and optimization for efficient data analysis for given case study | | |
| **PRACTICAL NO.05** | | **06 HOURS** |
| Accessing database using Python: In a Jupyter Notebook, create tables, load data, query data using SQL magic and SQLite python library. | | |

**TEXT BOOKS**

Allen G. Taylor. (2019). *SQL All - In - One For Dummies*. 3rd Edition, Wiley. ISBN 978- 8126534494.

Berg Craig. (2019). *SQL For Beginners: SQL Made Easy; A Step-By-Step Guide to SQL Pro- gramming for the Beginner, Intermediate and Advanced User (Including Projects and Exercises)*. 1st Edition, Antony Mwau. ISBN 978-1951737252.

Jiawei Han, Micheline Kamber, Jian Pei. (2022). *Data Mining: Concepts and Techniques*. 4th Edition, Elsevier Standard. ISBN 978-8131267660.

Rick Sherman. (2014). *Business Intelligence Guidebook: From Data Integration to Analytics*. 4th

**REFERENCE BOOKS**

Abraham Silberschatz, Henry F. Korth, S. Sudarshan. (2021). *Database System Concepts* . 7th Edition, McGraw-Hill Education. ISBN 978-9390727506.

Paulraj Ponniah (2012). *Data Warehousing: Fundamentals for IT Professionals*. 2nd Edition, Paperback, McGraw Hill Publishers. ISBN 978-0073523323.

Ralph Kimball.(2009). *Data Warehouse Lifecycle Toolkit*. 2nd Edition, Willey. ISBN 978-0470149775.

Maria Sueli Almeida, Missao Ishikawa, Joerg Reinschmidt, Torsten Roeber.(1999). *Getting Started with Data Warehouse and Business Intelligence*. 2nd Edition, IBM Redbook. ISBN 978-0738413747.

Ramesh Sharda, DursunDelen, Efraim Turban.(2019). *Getting Started with Data Warehouse and Business Intelligence*. 4th Edition, Pearson Education. ISBN 978-9353067021.

Hadley Wickham, Mine C¸ etinkaya-Rundel, Garrett Grolemund.(2023). *R for Data Science: Im- port, Tidy, Transform, Visualize, and Model Data*. 2nd Edition, O'Reilly. ISBN 978-9355429827.

Murrey R Spiegal, Larry Stifens. *Statistics*. 5th Edition,Schaum's Series, McGraw-Hill Education.

**E-CONTENTS/VIRTUAL LAB/ONLINE SIMULATOR LINKS**

1. https://www.w3schools.com/sql/default.asp

| MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Liberal Learning |
| | COURSE CODE | 2301182L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | - | 50 | 50 |

**COURSE OBJECTIVES :**

2301182L.CEO.1: Create a comprehensive understanding of diverse forms of expression that contribute to liberal education

2301182L.CEO.2: Create a broad set of skills and perspectives for overall development and personal well being.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301182L.CO.1: Develop proficiency in expressive arts, amateur interest for holistic development as a lifelong learning [L6].

2301182L.CO.2: Teach personal and social well-being through mind-body practices for the cultivation of free human beings [L3].

**COURSE ABSTRACT**

Liberal education is a learning approach that teaches students how to think independently and develop broad academic and intellectual abilities. It rests on a multidisciplinary and interdisciplinary approach. Education Policy, which had a revamp in 2020 has laid out a path for universities to adopt a liberal education, discussion based and discovery base mode of education. It encourages a multidisciplinary education system that helps develop the creative and analytical sides of the brain simultaneously. It inculcates transferable skill set, ability to apply knowledge to practical real-world situations, connecting the dots through various mental models, habits of self-reflection, contextual learning, freedom of the mind and lifelong learning. India needs a liberal education because to enhance Interdisciplinary and multidisciplinary approach to learning and Preparing students to become real-world person.

| **THEORY COURSE CONTENTS: Students may select any one of the following tracks.** | | |
|---|---|---|
| **Track 1** | **Chess** | **30 HOURS** |
| Introduction to game of Chess. Rules, movement of pieces, strengths and weaknesses of all pieces. Stalemate, touch move, etiquette, pawn promotion and zugzwang, square of the pawn. Fundamental checkmate patterns, basic rules, special moves and rules such as castling, promotion, EnPassant, good moves for the opening. | | |
| **Track 2** | **Kabaddi** | **30 HOURS** |
| Recent trends in kabaddi - History and Development. a) Different forms played - Zemini, Sanjeevani & Amar. b) Different chants (cant) - Hadu-Du, Chedu-Gudu, Hu-tutu & other forms. c) Played in different size playfields with different number of players. d) No uniform rules and regulations, Traditional Kabaddi, Modern Kabaddi. Kabaddi Pioneers: Raiders, Escaping tactics by raiders in different situation, Before starting of the raid strategies, during the raid strategy and tactics, Turning, Falling and sliding as tactics, Creating gap to escape . | | |
| **Track 3** | **Drama** | **30 HOURS** |
| Introduction to Acting, Introduction to Theatre Techniques and Design Theatre History, Literature and Aesthetics, basics of Acting, Theatre Techniques and Design, and Theatre History, Literature and Aesthetics. In the second semester the same subjects are studied in details. Specialisation in Acting, Theatre Techniques and Design Theatre History, Literature and Aesthetic. Theatre History, Literature and Aesthetics, Acting (specialisation). | | |
| **Track 4** | **Singing** | **30 HOURS** |
| Vocal cords, Voice types, Female: Soprano or alto, Male: Tenor, baritone or bass, Breathing Techniques, Role of breathing in singing, types of scales and pitches, Musical notes foundation of any song, Humming exercise, tongue twisters, vowels, Tempo of song, Tempo Markings, Practicing all octaves, analysis of songs, practicing songs. | | |

| Track 5 | Dance | 30 HOURS |
|---|---|---|
| History, mythological aspects, and their impact on the dance form, movements, pattern of beats, use of these forms, Basic knowledge of: basic Adavu steps, hand gestures 'Mudra', Nritta, nrittya and Natakas, Tala, Gati, postures, moods, feet movements, and stances. Introduction to Bollywood dance, Basic Bollywood combinations/choreography, Introduction of styles of Bollywood, Introduction of dance choreographies from classic and modern Bollywood films, influence and inclusion of western dance. History of street dance steps and styles and the pioneers and dance legends involved in their creation, Basic steps of Hip Hop dance, Learn foundations & routines within hip hop culture, Types of hip hop: contemporary hip hop, lyrical hip hop, etc. Dance history, Learning about warm ups, floor work, standing work, travelling work, articulation of limbs, turns and jumps etc. | | |
| **Track 6** | **Painting (Design)** | **30 HOURS** |
| Object Drawing / Still Life - Graphic sketching, mutual proportion of object groups, space joiner, shadow differentiation on objects, Sketching and painting of object groups Memory Drawing - observa- tion, memory and imagination, proportional sketching of incidents in daily life, closeness and distantness (perspective) in drawing. Design – creative expression, basic principles of design, effective use of colors and color shades, aesthetic sense and creation of utility through design, geometrical equipment and material, color mediums and techniques. Geometry, Solid Geometry and Lettering - Development of capability of use of geometrical constructions for creation of pattern, geometrical shapes and their construction. | | |
| **Track 7** | **Sculpture Design** | **30 HOURS** |
| The fundamental principles and techniques of sculpture, including the exploration of various materials and processes, sculptural skills and conceptual thinking. Introduction to sculpture, Brief history of sculpture, tools handling and techniques, material handling techniques, methods & applications – additive & subtractive, pinching method & slab method (application), concepts Development - perceive line as an edge, understanding fundamental elements & principles of sculpture tools handling and techniques, concept understanding. | | |
| **Track 8** | **Introduction to photography** | **30 HOURS** |
| Types of Lights, effect of Lights, Types of Lenses & their uses. Understanding the three main ingre- dients or elements or pillars of photography that work together: Aperture, Shutter Speed, and ISO. Understanding the concept of ISO sensitivity, in detail with hands-on session. Understanding the concept of Shutter Speed, effect of high & low shutter speed on photographs, with hands-on session. Concept of aperture, F-stop notations, effect of variation of aperture on images. Hands-on session. Compositional Rules like Rule of Thirds, Negative Space, Horizon Line, Golden ratio etc. Framing. Hands-on training. Difference between Auto focus & manual focus, Focusing the object manually, concept of depth of field with wide aperture lens. Hands-on. Framing in landscape photography, bird photography framing. Bokhe effect, Time lapse, multiple exposure, Silhouettes, Long exposure, Steel wool photography. | | |

| Track 9 | Yoga and Meditation | 30 HOURS |
|---|---|---|
| Brief history and philosophy of Yoga, benefits of Yoga, Key techniques of Yoga. Introduction to dif- ferent types of Yoga, understanding the diversity of yoga practices and their origins, Yoga-Sutras, Limbs of Yoga. Introduction to Meditation, understanding the essence and benefits of meditation, introduction to different types and approaches to meditation, Meditation techniques for health pro- motion, Relaxation techniques. Overview of Postural alignment, importance of postures, Practices of various posture. Understanding the importance of a balanced diet for overall well-being, Principles of balanced nutrition, diet for preventive and curative aspects of health, Mind Power. Gentle warm-up and stretching, Introduction to seated forward bends and gentle backbends, Relaxation techniques: Guided progressive muscle relaxation. Introduction to breathing and its significance, understanding the role of breathing in overall well-being, importance of conscious breathing in stress reduction and relaxation. Yogic breathings techniques. Intended to various Asana, benefits of Asana. Introduc- tion to pranayama, pranayama techniques for health promotion practical sessions, difference between pranayama and deep breathing, Anuloma-viloma, Suryabhedana, Ujjayi, Bharmari, Bhastrika, Shitali and Shitkari Pranayama. Understanding of Mudras and Kriyas, Practical sessions . | | |
| **Track 10** | **Spiritual Minds** | **30 HOURS** |
| 1.Spirituality -True meaning of Spirituality and explaining the hierarchy of Inner world, awareness about Existence of God.2.Yoga & Meditation- Explaining the Chakras and the Aura, various types of Mediations.3.Respect, Gratitude & Reverence -Explaining the meaning Respect, Gratitude & Rever- ence by giving the examples from Mahabharata and try to cultivate these qualities in the students.4.Low of Forgiveness and Low of KARMA- Explaining the deepest meaning of Law of forgiveness and Law of KARMA and make the student refrain from unwholesome actions and behaviors.5.Relationship- how to maintain and improve the relationship with Parents, friends, people around us and NATURE.6.Physical and Mental Health – how to improve Physical and Mental health with the help of circadian rhythm, mediation, Pranayamas and yogasanas. How to become more productive.7.Stress Management- dis- cuss the root cause of stress, types of Stress. Explain the techniques and remedies to overcome the Stress.8.Love Yourself – How to give quality time to 'yourself', how to make yourself anxiety free and find the real happiness within us.9.Let's Label jars and not people- how to refrain from to criticism and judgmental with the people around us.10.Goal setting- how to set goals in your life and how to achieve those goals in a positive manner. | | |
| **Track 11** | **Content Writing** | **30 HOURS** |
| Introduction to Content Writing, Writing Fundamentals, Research skills, Blog Writing, Website Writ- ing, Role of SEO in Content Writing, Content Marketing Strategy, Portfolio Development & Career Opportunities, Branding (in copywriting point of view), Technical writing, UX/UI writing, AI in con- tent writing (ChatGPT). | | |

| Track 12 | Digital Marketing | 30 HOURS |
|---|---|---|
| Basics digital marketing, analysis and keyword research, search engine optimization, on-page opti- mization, off-page optimization, SEO updates and analysis, local business and google mapping, google adwords or pay per click marketing (SEM), social media optimization, social media marketing, google web analytics, webmaster tools, creating a new simple website. Illustrating the dialog delivery, expres- sions, volume, pitch in the dialog, Expression through photography and editing skill with an expertise in handling cameras, microphone, effective management skill enabling the justification through foundation till representation. | | |
| **Track 13** | **Social Work** | **30 HOURS** |
| Importance of Empathy, Empathy and it's limits, Role of empathy and compassion for engineers, Empathy activities, Differences, Conservatives and Liberals, Disgust and Honor, Stereotypes, The Problem of Kindness, Skepticism About the Self, Free Will and the Situation, Recognizing emotions, reading body language, improving listening skills, mindful self-compassion, Compassionate Leadership, Origins of Morality, joy of giving, social responsibility, exercising social services. | | |
| **Track 14** | **Indian Food Wisdom** | **30 HOURS** |
| History - Introduction, Food consumed in different regions of India, Eating styles of India, Traditional equipment's used for cooking, changes in consumption of foods, Future of traditional foods, Advantages, types, health benefits of Indian food, Millets – Importance of millets in diet, millet as a medicine etc. | | |
| **Track 15** | **Creative Writing** | **30 HOURS** |
| This syllabus offers an introduction to the fundamentals of creative writing, beginning with techniques on how to read like a reader and understand literary aspects across different genres and forms. The course delves into various types of writing, including short stories, poetry, and blogs. In the Short Story Writing section, students will explore key elements of storytelling, learn effective writing techniques, and engage in practical exercises to craft their own stories. The Poetry Writing module includes reading and analyzing poems, discussing contemporary poets and their work, followed by generative exercises and review sessions for writing original poems. The Blog Writing segment introduces the concept of blogging, explores different types of blogs, and provides practical experience in writing and publishing blog posts. Throughout the course, students will enhance their creative expression through various writing practices and peer reviews. | | |
| **Track 16** | **Cinematography** | **30 HOURS** |
| A Basic Cinematography could focus on: Fundamental Concepts: Exposure, aperture, shutter speed, ISO, and their interplay. Composition: Rule of thirds, leading lines, depth of field, and framing techniques. Lighting: Three-point lighting, high-key and low-key lighting, and color temperature. Camera Movement: Panning, tilting, tracking, zooming, and their effects on storytelling. Lenses: Wide-angle, normal, and telephoto lenses, and their use in different situations. Basic Equipment: Understanding cameras, lenses, tripods, and other essential gear. By covering these essential elements, a basic cinematography can provide a solid foundation for beginners to grasp the core principles of filmmaking. | | |

| Track 17 | Podcasting | 30 HOURS |
|---|---|---|
| Introduction to Podcasting: Overview of podcasting, types of podcasts, and the current landscape. Concept Development: Identifying your niche, target audience, and defining podcast goals. Equipment and Software Basics: Overview of microphones, recording software, and setting up a recording envi- ronment. Recording Techniques: Best practices for recording quality audio, including voice techniques and interview skills. Editing Basics: Introduction to editing software, cutting, splicing, and adding basic sound effects. Branding and Cover Art: Creating a strong podcast name, logo, and cover art that resonates with your audience. Hosting and Distribution: Choosing a hosting platform, understanding RSS feeds, and submitting to directories. Marketing and Promotion: Strategies for promoting your podcast through social media, SEO, and collaborations. Monetization Strategies: Exploring sponsor- ships, advertisements, and crowdfunding opportunities. Analytics and Growth: Understanding podcast analytics, audience engagement, and strategies for scaling your podcast. | | |
| **Track 18** | **Public Speaking** | **30 HOURS** |
| Introduction to Public Speaking: Understanding the fundamentals and importance of effective com- munication. Speech Structure: Crafting clear, compelling openings, bodies, and conclusions. Audience Analysis: Tailoring content and delivery to engage different audiences. Verbal and Nonverbal Commu- nication: Mastering tone, pitch, gestures, and body language. Overcoming Speech Anxiety: Techniques for managing nervousness and building confidence. Persuasive Speaking: Strategies for convincing and influencing audiences. Impromptu Speaking: Developing skills for spontaneous speech delivery. Use of Visual Aids: Enhancing speeches with slides, props, and other media. Effective Storytelling: Using stories to connect with and captivate audiences. Final Speech Presentation: Delivering a polished speech with peer and instructor feedback. | | |
| **Track 19** | **Regional Language Literature** | **30 HOURS** |
| The syllabus offers a comprehensive exploration of Marathi literature, focusing on its history and various streams. It highlights prominent Marathi story writers and their distinctive features, providing insight into different storytelling styles and techniques. Students will learn about the essential elements of a story, including plot, characters, dialogue, and events, and develop skills in story reading, such as voice modulation, rhythm, and expression. The course covers techniques for effective story presentation on stage, emphasizing audience engagement. Additionally, it addresses the importance and methods of selecting stories on diverse topics. Students will also learn the basics of story writing, with opportunities to craft their own stories. The syllabus includes the reading and discussion of famous Marathi stories, culminating in a practical session where students present their storytelling, receive feedback, and gain guidance for improvement. | | |

| Track 20 | Creative Graphics | 30 HOURS |
|---|---|---|
| This syllabus provides a comprehensive introduction to graphic design, focusing on the concept of a ”creative” and its importance in the design process. It explores key aspects of creativity in graphic design, including various types of creatives and how to select the appropriate one based on the intended purpose. The course delves into different tools used in graphic design, with a special emphasis on CANVA as an effective design tool. Students will get familiar with the CANVA interface, learn to select appropriate design templates, and choose suitable elements for their projects. The syllabus also covers sourcing license-free and copyright-free images to enhance designs. The course culminates in creating effective creatives and building a portfolio of completed designs, equipping students with the skills and knowledge needed to succeed in graphic design. | | |

| Track 21 | Indian Dietary Practices | 30 HOURS |
|---|---|---|
| This syllabus explores the power and benefits of Indian traditional foods, focusing on their rich nutritional value and significant health advantages. It delves into the world of Indian superfoods, with a particular emphasis on millet, highlighting its role and importance in maintaining a balanced diet. The course offers an in-depth examination of the diverse foods consumed across different regions of India, taking into account various dietary restrictions, cultural influences, and the role these factors play in shaping regional food choices. Additionally, it emphasizes the importance of understanding and appreciating the vast regional diversity in Indian cuisine, and how these traditional diets contribute to overall health and well-being. Through this course, students will gain a comprehensive understanding of the significance of traditional Indian foods and how they can be integrated into modern dietary practices for enhanced health benefits. | | |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE (AI ML) | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Indian Knowledge Systems (Vedic Mathematics) |
| | COURSE CODE | 2311181T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 25 | NIL | 50 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

23111181T.CEO.1: To facilitate the students with the concepts of Indian traditional knowledge

2311181T.CEO.2: To make them understand the Importance of roots of knowledge system.

2311181T.CEO.3: To encourage students to think creatively and critically about mathematical concepts

2311181T.CEO.4: To bring forward the extraordinary work done by Indian Mathematicians in the fields such as Astronomy, Astrology

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311181T.CO.1: Explain the historicity and broad classification of Indian knowledge System [L2].

2311181T.CO.2: Demonstrate key Vedic Mathematics principles by understanding foundational concepts and providing clear insights into the underlying principles and relationships [L2].

2311181T.CO.3: Apply Vedic mathematics methods to solve a variety of mathematical problems, show- casing proficiency in applying these techniques to diverse scenarios [L3].

2311181T.CO.4: Analyze and evaluate the efficiency and suitability of different Vedic mathematics ap- proaches in solving specific types of problems demonstrated through a detailed project or case study presentation [L3].

**COURSE ABSTRACT:**

Course outlines the importance of Indian Knowledge System and its contributions to diverse fields.This course will help learners to know and understand their own systems and traditions which are imperative for any real development and progress. Because of this course learners will think independently and originally with Indian frameworks and models for solving the problems of present day. Vedic Mathe- matics will not have direct application in DEPARTMENT OF ARTIFICIAL INTELLIGENCE as a specialized field, however it offers benefits and insights that are relevant in certain context. It will be used in logic development, Problem Solving, data analysis and designing of algorithms. Recognizing methodologies to simplify calculation is one of the skill in Vedic Mathematics. This skill can be valuable in dealing with complex real life applications.Deeper concepts helpful in Programming context, problem solving skills can be considered as outcomes of Vedic Mathematics in DEPARTMENT OF ARTIFICIAL INTELLIGENCE discipline.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Indian Knowledge System – An Introduction** | **04 HOURS** |

**Applications/Case Study:** Connections between different fields of study and an affection for tradi- tional knowledge
**Contents:** Introduction and need of IKS; historic importance of IKS; Why do we need IKS; Organi- zation of IKS; Historicity of IKS; Some salient aspects of IKS
**Further Readings/Self Study:** Linkage of Mathematics and IKS

| | | |
|---|---|---|
| **UNIT 2** | **Introduction to Indian Mathematics** | **02 HOURS** |

**Applications/Case Study:** Mathematical Innovations in $17^{th}$ and $18^{th}$ Century
**Contents:** Introduction to Indian Mathematics; Unique aspects of Indian Mathematics; Indian Math- ematicians and their Contributions
**Further Readings/Self Study:** Impact of Mathematical Innovations on society

| | | |
|---|---|---|
| **UNIT 3** | **Deep Insights in to Indian Mathematics** | **12 HOURS** |

**Applications/Case Study:** Basic Sutras and subsutras in Vedic Mathematics
**Contents:** Arithmetic; Algebra; Geometry; Trigonometry; Binary mathematics and combinational problems in Chandah. S´¯astra; Magic squares in India
**Further Readings/Self Study:** application of Chandah. S´¯astra in designing of algorithms

| | | |
|---|---|---|
| **UNIT 4** | **Astronomy** | **04 HOURS** |

**Applications/Case Study:** Linear measures of celestial coordinate system.
**Contents:** Unique Aspects of Indian Astronomy, Historical Development, The Celestial Coordinate System, Elements of the Indian Calendar.
**Further Readings/Self Study:** Positional Astronomy.

| ACTIVITY(a) | Activity Based on IKS (25 Marks) | 01 HOUR |
|---|---|---|
| Activity based on the IKS will assess student's knowledge and comprehension of the course content. The purpose of the activity is to evaluate the participants' understanding and knowledge of IKS. | | |
| **ACTIVITY(b)** | **Field Visit and Report Writing (25 Marks)** | **08 HOURS** |

Students are required to conduct a field visit to the local places mentioned below.Upon completion of the field visit, students must write a report on the visit, its analysis,and submit the detail report for assessment

**Field Visit Guideline :**

**Archaeological Sites:** Visit archaeological sites like ancient temples and caves (Karla, Bhaja Bedse Caves, old temples) Vedic mathematics emphasizes geometric principles and formulas. These principles may have been applied in the design and construction of ancient temples and caves. These architecture often involves intricate geometric patterns and proportions, which could have been influenced by Vedic mathematical concepts.

**Museums:** Explore museums that exhibit ancient artifacts, tools, and techniques. (Raja Dinkar Kelkar Museum, Mahatma Phule Museum, Deccan College Museum, Darshan Museum) Observe any mathematical symbols, notations, or representations found in ancient artifacts. These can provide clues about how mathematical concepts were recorded and communicated in ancient times.

**Historical Monuments:** Visit historical sites featuring iconic artifacts. (Aga Khan Palace, Shaniwar Wada, Sinhgad Fort) Recognize the interdisciplinary nature of Vedic mathematics by understanding its connections to architecture, astronomy, and religious practices. Explore how mathematics played a role in these diverse fields. Appreciate the importance of preserving and conserving archaeological sites that offer insights into Vedic mathematics and ancient knowledge systems.

**Educational Institutions:** Visit universities or research institutes with metallurgy departments. These institutions often have laboratories and facilities that demonstrate cutting-edge research in Mathematics e.g. Savitribai Phule Pune University, Indian Institute of Science Education and Research (IISER), College Technological University, Pune (COEP) Recognize how the mathematical achieve- ments of ancient India, including Vedic mathematics, continue to inspire modern mathematicians and
educators.

| ACTIVITY(c) | Multimodal Activities (25 Marks) | 04 HOURS |
|---|---|---|

Students are required to perform any one activity as assessment and submit: The activity evaluates students understanding and application of Vedic Mathematics principles. It includes a range of math- ematical problems and calculations based on Vedic techniques. Assessment criteria may encompass accuracy, speed, and proficiency in employing Vedic Math methods to problems.

**Poster Presentation:** Students are required to create a visually appealing and informative poster that summarizes a specific topic or concept related to the course. The poster should effectively convey key points, including information, visuals. Assessment criteria may include content clarity, visual design, organization, and the ability to articulate ideas during the presentation.

**Video Documentary:** Students are tasked with producing a short video documentary that explores a particular aspect of the course. This assessment component encourages students to research, script, film, and edit a video that presents their chosen topic in a compelling and informative manner. Eval- uation criteria may include content accuracy, storytelling, production quality, and overall impact.

**Model Making:** In this task, students are asked to create a physical model or representation of a concept or object relevant to the course. The model should demonstrate a deep understanding of the subject matter and may include annotations or explanations to clarify its significance. Assess- ment criteria could include accuracy, creativity, craftsmanship, and the ability to explain the model's relevance.

**Product Making:** This component challenges students to design and produce a practical product or prototype related to the course content. Students design and craft practical products or prototypes inspired by Indian Knowledge System principles. This hands-on activity fosters creativity and practical application of IKS Students may need to consider materials, functionality, and how their product
addresses a real-world problem or application. Evaluation might focus

**TEXT BOOKS**

Mahadevan B., Pavana N., Bhat Vinayak R.,(2022). *Introduction to Indian Knowledge System: Concepts and Applications*. 1st Edition, PHI Learning. ISBN 978-9391818203.

Patil Chaitanya A.,(2018). *Learn Vedic Speed Mathematics Systematically and Step by Step*. 1st Edition, Chaitanya A. Patil Publication. ISBN 9789353008406.

**REFERENCE BOOKS**

Bose, D. M. Sen, S.N. Subbarayappa,B. V. (2010). A Concise History of Science in India. 2nd Edition, Universities Press Publisher, Hyderabad. ISBN 9788173716195.

Boyer Carl B., (2011). A History of Mathematics. 3rd Edition. Wiley Publication. ISBN 9780470630563

Cooke Roger L. (2011). The History of Mathematics: A Brief Course. 2ND Edition. Wiley Publication. ISBN 9781118030240

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Statistics and Integral Calculus |
| | COURSE CODE | 2301103T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301103T.CEO.1: To extend the basic concepts of integration for evaluation of complex integration problems.

2301103T.CEO.2: To categorize and use equation of curves to trace the given curve.

2301103T.CEO.3: To demonstrate an understanding towards evaluating multiple integrals.

2301103T.CEO.4: To relate and examine the applications of multiple integrals.

2301103T.CEO.5: To study different statistical methods for solving problems.

2301103T.CEO.6: To analyse different probability distribution functions.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301103T.CO.1: Evaluate complex integrals [L3].

2301103T.CO.2: Sketch curves by analysing the given equation of curves [L3].

2301103T.CO.3: Evaluate the multiple integrals [L3].

2301103T.CO.4: Apply the knowledge of multiple integrals to solve engineering problems [L3].

2301103T.CO.5: Assess statistical problems [L4].

2301103T.CO.6: Solve the probability distribution problems [L3].

**COURSE ABSTRACT**

This course includes some of the main ideas on integral calculus, a wide domain of mathematics that has many applications relevant to the future engineer. Also included different methods of computing integrals and applications of multiple integrals as area, volume, centre of gravity and moment of iner- tia using different types of examples.Main objective of this course is to identify different methods to evaluate integrals, to demonstrate an understanding towards evaluating multiple integrals, to relate and examine the applications of multiple integrals, to analyze different probability distribution functions, to study different statistical methods for solving problems.It explains the concepts of probability theory and statistics which are needed for handling various real- world problems.As a part of the studies we emphasize more on real life applications of the topics and based on that different activities are also conducting in timely manner. By doing this we inculcate the curiosity of the students towards research.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Integral Calculus** | **08 HOURS** |
| **Contents:** Reduction formulae, Gamma function, Beta function, Differentiation under integral sign.<br>**Self Study:** DUIS rule 2 | | |
| **UNIT 2** | **Curve Tracing and Rectification** | **07 HOURS** |
| **Applications/Case Study:** Rose Curves<br>**Contents:** Tracing of Curves: Cartesian curves, Parametric curves, Polar curves. Rectification: Rec- tification of Cartesian, Parametric and Polar curves .<br>**Self Study:** Parametric Curves . | | |
| **UNIT 3** | **Multiple Integrals** | **07 HOURS** |
| **Contents:** Double integration, Evaluation of Double integration, Change of order of Integration, Integration by transforming Cartesian to polar coordinate systems, Triple Integration, Integration by transforming to spherical and cylindrical polar coordinates.<br>**Self Study:** Coordinate system. | | |
| **UNIT 4** | **Applications of Multiple Integrals** | **07 HOURS** |
| **Contents:** Applications of multiple integrals to find Area, Volume, Centre of Gravity, and<br>**Self Study:** Moment of Inertia. | | |
| **UNIT 5** | **Statistics** | **08 HOURS** |
| **Applications/Case Study:** Corona Graph.<br>**Contents:** Measures of central tendency, standard deviation, coefficient of variation, moments, skew- ness and kurtosis, correlation(Karl Pearson's coefficient of correlation) and regression .<br>**Self Study:** Measures of Central Tendency,Standard Deviation,Coefficient of Variation | | |
| **UNIT 6** | **Probability** | **08 HOURS** |
| **Contents:** Probability, probability density function, probability distribution: Binomial, Poisson, Nor- mal.<br>**Self Study:** Bayes' Theorem. | | |

**TEXT BOOKS**

1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.

**REFERENCE BOOKS**

Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379- 8858). Addison-Wesley.

Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.

Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.

Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.

O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.

Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.

Montgomery, D. C., & Runger, G. C. (2010). Applied statistics and probability for engineers. John wiley & sons.

Johnson, R. A., Miller, I., & Freund, J. E. (2000). Probability and statistics for engineers (Vol. 2000, p. 642p). London: Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Statistics and Integral Calculus Tutorial |
| | COURSE CODE | 2301103TU |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | TUTORIAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 1 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301103TU.CEO.1: To extend the basic concepts of integration for evaluation of complex integration problems.

2301103TU.CEO.2: To categorize and use equation of curves to trace the given curve.

2301103TU.CEO.3: To demonstrate an understanding towards evaluating multiple integrals.

2301103TU.CEO.4: To relate and examine the applications of multiple integrals.

2301103TU.CEO.5: To study different statistical methods for solving problems. 2301103TU.CEO.6: To analyse different probability distribution functions.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301103TU.CO.1: Evaluate complex integrals [L3].

2301103TU.CO.2: Sketch curves by analysing the given equation of curves [L3]. 2301103TU.CO.3: Evaluate the multiple integrals [L3].

2301103TU.CO.4: Apply the knowledge of multiple integrals to solve engineering problems [L3].

2301103TU.CO.5: Assess statistical problems [L4]. 2301103TU.CO.6: Solve the probability distribution problems [L3].

**COURSE ABSTRACT**

This course includes some of the main ideas on integral calculus, a wide domain of mathematics that has many applications relevant to the future engineer. Also included different methods of computing integrals and applications of multiple integrals as area, volume, centre of gravity and moment of iner- tia using different types of examples.Main objective of this course is to identify different methods to evaluate integrals, to demonstrate an understanding towards evaluating multiple integrals, to relate and examine the applications of multiple integrals, to analyze different probability distribution functions, to study different statistical methods for solving problems.It explains the concepts of probability theory and statistics which are needed for handling various real- world problems.As a part of the studies we emphasize more on real life applications of the topics and based on that different activities are also conducting in timely manner. By doing this we inculcate the curiosity of the students towards research.

| **TUTORIALS** | | |
|---|---|---|
| **TUTORIAL NO.01** | **Integral Calculus** | **01 HOUR** |
| Reduction formulae, Gamma function. | | |
| **TUTORIAL NO.02** | **Integral Calculus** | **01 HOUR** |
| Beta function, DUIS Rule1 & 2. | | |
| **TUTORIAL NO.03** | **Curve Tracing** | **01 HOUR** |
| Tracing of Cartesian, Polar and Parametric curves. | | |
| **TUTORIAL NO.04** | **Rectification** | **01 HOUR** |
| Rectification of Cartesian, Polar and Parametric curves. | | |
| **TUTORIAL NO.05** | **Double Integration** | **01 HOUR** |
| Double Integration, Evaluation of Double Integration, Change the order of integration, Integration by transforming Cartesian to Polar Coordinate system. | | |
| **TUTORIAL NO.06** | **Triple Integration** | **01 HOUR** |
| Triple integration, Integration by transforming to spherical and cylindrical polar coordinates. Appli- cation Of multiple integrals: To find Area, Volume. | | |
| **TUTORIAL NO.07** | **Applications of Multiple Integrals** | **01 HOUR** |
| Applications of multiple integrals: To find Centre of Gravity of an arc, plane lamina and a solid. | | |
| **TUTORIAL NO.08** | **Applications of Multiple Integrals** | **01 HOUR** |
| Applications of multiple integrals: To find Moment of Inertia about an arc, plane and solid. | | |
| **TUTORIAL NO.09** | **Statistics** | **01 HOUR** |
| Measures of central tendency, standard deviation, coefficient of variation. | | |
| **TUTORIAL NO.10** | **Statistics** | **01 HOUR** |

| |
|---|
| Moments, skewness and kurtosis, Correlation and regression. |

| | | |
|---|---|---|
| **TUTORIAL NO.11** | **Probability** | **01 HOUR** |
| Probability, probability density function. | | |
| **TUTORIAL NO.12** | **Probability** | **01 HOUR** |
| , Probability distribution: Binomial, Poisson, Normal. | | |
| **TUTORIAL NO.13** | **Guest Lecture** | **02 HOUR** |
| Applications of statistics in real life. | | |
| **TUTORIAL NO.14** | **Doubt Clearing Session** | **01 HOUR** |
| Unit 1 - Unit 6. | | |

**TEXT BOOKS**

1. Ramana, B. V. (2017). Higher Engineering Mathematics. Tata McGraw-Hill Education.

**REFERENCE BOOKS**

Thomas, G. B., Weir, M. D., Hass, J., & Giordano, F. R. (2002). Thomas' calculus (pp. 2379- 8858). Addison-Wesley.

Kreyszig, E. (2015). Advanced Engineering Mathematics 10E All Access Pack. John Wiley & Sons.

Grewal, B. S., & Grewal, J. S. (2018). Higher engineering mathematics. 2002, Khanna Publishers, New Delhi.

Jain, R. K., & Iyengar, S. R. K. (2002). Advanced Engineering Mathematics, Narosa Pub.

O'Neil, P. V. (2012). Engineering Mathematics. Foxwell, Birmingham.

Zill, D. G., & Wright, W. S. (2011). Engineering Mathematics.

Montgomery, D. C., & Runger, G. C. (2010). Applied statistics and probability for engineers. John wiley & sons.

Johnson, R. A., Miller, I., & Freund, J. E. (2000). Probability and statistics for engineers (Vol. 2000, p. 642p). London: Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Engineering Physics |
| | COURSE CODE | 2301102T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**COURSE OBJECTIVES :**

2301102T.CEO.1: Make students identify the basic concept of measurements and to formulate problems in physical and mathematical terms.

2301102T.CEO.2: Analyze the behavior of light as a wave and get acquaint with different applications in Physics.

2301102T.CEO.3: Classify and understand the difference of classical mechanics and quantum mechan- ics.

2301102T.CEO.4: Derive the basic laws governing the motion of quantum particles.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301102T.CO.1: Make use of the basics of measurement aspects to obtain acceptable solutions under given conditions [L3].

2301102T.CO.2: Infer theoretical principles of optical phenomenon observed in daily life experience [L4].

2301102T.CO.3: Apply the knowledge of quantum mechanics to study the behavior of quantum parti- cles [L3].

2301102T.CO.4: Analyze the necessity of quantum mechanics in context of failure of classical mechanics [L4].

**COURSE ABSTRACT**

Since 'technology' has been generally understood as the application of 'science' to find answers to questions confronting us in a wide spectrum of inquiry, so a profound understanding of science is necessary to facilitate building sound intellectual capacity in the area of technology. Various areas of engineering studies are found to be applying concepts discussed in Physics as for instance measurement, optics, quantum-mechanics to name a few which have been instrumental/ pivotal in the development of En- gineering branches like Robotics, Mechanical Engineering, Computer Science, Chemical Engineering, Civil Engineering and Electronics and Telecommunications; besides other specific allied areas as Ar- tificial Intelligence, Big-Data Analysis and Quantum Computing. The course of Engineering Physics discusses the basics and analyses the understanding of topics like measurement of physical variables, wave-phenomenon, basics of Quantum Mechanics and its applications thereof. Most of the contents of this course act as a mandatory in terms of extrapolating its further extension to address the basics of Quantum Computing and other such emerging technologies.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Measurement of Physical Quantities** | **6 HOURS** |

**Applications/Case Study:** Measuring methods in classical mechanics, measuring methods in quan- tum mechanics.

**Contents:** Concept of (i)significant numbers, (ii) accuracy versus precision (iii)error versus uncertainty (iv)systematic error versus random error (v) quantifying the uncertainty. Least-count of an apparatus, Methods to measure least-count with specific examples of travelling microscope and spectrometer. im- portance of estimation and guesstimation in measurement.

**Self Study:** Span (orders of magnitude) of prominent physical parameters. Length-scale and time- scale of specific physical phenomenon, classical-mechanical-measurement versus quantum-mechanical-
measurement.

| | | |
|---|---|---|
| **UNIT 2** | **Wave Properties of Light** | **8 HOURS** |

**Applications/Case Study:**Coating of lenses as an application of thin film interference.

**Contents:** Particle nature and wave-nature with examples of wave and particle behavior of light, Introduction to wave nature, Concept of thin film, Stokes law of phase-change on reflection from a thin film, Thin film interference, Interference in films of uniform and non-uniform thickness (with derivation), Newton Ring Experiment, basics of polarization of electromagnetic wave.

**Self Study:** Superposition Principle, Applications of thin-film interference, Diffraction as a particular
case of interference, Application of polarized light.

| | | |
|---|---|---|
| **UNIT 3** | **Quantum Mechanics-I** | **8 HOURS** |

**Applications/Case Study:** Plank's quantum law of blackbody radiation

**Contents:** Shortcomings or failure of Classical Mechanics (with specific example of blackbody radia- tion), Matter-waves, De-Broglie's concept of matter waves, Heisenberg's Uncertainty Principle.

**Self Study:** Blackbody radiation.

| UNIT 4 | Quantum Mechanics-II | 8 HOURS |
|---|---|---|

**Applications/Case Study:** Application of electron in a potential well in case of Bohr's atomic model. **Contents:** Wave-function, Physical significance of wave function, Schrodinger's equations, Time De- pendent and Time Independent forms of Schrodinger Equations, Applications of Schrodinger Equation, Electron in an infinite potential well (rigid box).

**Self Study:** Electron in a finite deep potential well (non-rigid box).

**Further Study:** Concept of quantum mechanical tunneling

**TEXT BOOKS**

Feynman R.P., Leighton R.B., Sands M. (2013). The Feynman Lectures on Physics: (Vols.1-3) Narosa Publishing House.

Ghatak A. (2016). Optics (6th edition). TMH.

**REFERENCE BOOKS**

Morris A.S. (2001). Measurement and Instrumentation Principles (3rd edition). Butterworth Heinemann.

Jenkins & White (2016). Fundamentals of Optics (4th edition). Mc Graw Hill Science.

Beiser A., Mahajan S., Choudhary S.R. (2009) Concepts of Modern Physics (6th edition). Mc Graw Hill Education (India) Pvt. Ltd.

Schiff L.I., Bandhyopadhyay J. (2017) Quantum Mechanics (4th edition). MH Education (India) Pvt. Ltd.

Dirac P.A.M. (2004) Principles of Quantum Mechanics (4th edition). CBS publishers and Distributors 2004.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Engineering Physics Lab |
| | COURSE CODE | 2301102L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**COURSE OBJECTIVES :**

2301102L.CEO.1: To acquire hands-on experience in setting up and using fundamental physics appa- ratus.

2301102L.CEO.2: To cultivate students' ability to conduct experiments, analyze data, and draw mean- ingful conclusions.

2301102L.CEO.3: Encourage students to identify sources of experimental error, and propose improve- ments.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301102L.CO.1: Demonstrate proficiency in using basic laboratory equipment relevant to physics ex- periments [L2].

2301102L.CO.2: Develop analytical skills to analyze the experimental data obtained from measurement of physical variables [L3].

2301102L.CO.3: Develop improved experimental- skills evidenced by their ability to identify sources of errors and propose appropriate

**COURSE ABSTRACT**

Since 'technology' has been generally understood as the application of 'science' to find answers to questions confronting us in a wide spectrum of inquiry, so a profound understanding of science is necessary to facilitate building sound intellectual capacity in the area of technology. Various areas of engineering studies are found to be applying concepts discussed in Physics as for instance measurement, optics, quantum-mechanics to name a few which have been instrumental/ pivotal in the development of En- gineering branches like Robotics, Mechanical Engineering, Computer Science, Chemical Engineering, Civil Engineering and Electronics and Telecommunications; besides other specific allied areas as Ar- tificial Intelligence, Big-Data Analysis and Quantum Computing. The course of Engineering Physics discusses the basics and analyses the understanding of topics like measurement of physical variables, wave-phenomenon, basics of Quantum Mechanics and its applications thereof. Most of the contents of this course act as a mandatory in terms of extrapolating its further extension to address the basics of Quantum Computing and other such emerging technologies.

**PRACTICALS**: Seven (7) number of experiments among those listed below to be conducted. Maximum two experiments may be substituted (by faculty in consultation with students)
with Experimental hands-on activity/ies among those listed below.

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Interpretation of given data** | **2 HOURS** |
| Analysis of a given data set in terms of implied uncertainties and tolerance to evaluate validity of a result. (Note: The given data may be in terms of graph as well). | | |
| **PRACTICAL NO.02** | **Estimation and guesstimation** | **2 HOURS** |
| To predict the expected outcome of a given experimental problem under scientific reasoning justifying the experimental conditions. | | |
| **PRACTICAL NO.03** | **Significant Figures** | **2 HOURS** |
| Determination of the mass of electron (me) upto specified significant numbers. | | |
| **PRACTICAL NO.04** | **Interference of Light Waves** | **2 HOURS** |
| Calculate the refractive index of a given liquid using Newton Rings' Experiment. | | |
| **PRACTICAL NO.05** | **Diffraction of Light Waves** | **2 HOURS** |
| Determination of the line density of a diffraction grating using Laser. | | |
| **PRACTICAL NO.06** | **Interference of Light Waves** | **2 HOURS** |
| Calculate the wavelength of Sodium light source using Michelson Interferometer. | | |
| **PRACTICAL NO.07** | **Phase and Phase-Difference** | **2 HOURS** |
| Determination of the phase-difference between two given positions on the path of simple pendulum in periodic motion. | | |
| **PRACTICAL NO.08** | **Polarization** | **2 HOURS** |
| Determination of the specific rotation of a sugar solution of a given concentration. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.9** | **Division of Amplitude of Light Waves** | **2 HOURS** |
| Determination of Radius of Curvature of a given planoconvex lens using Newton's Rings apparatus. | | |
| **PRACTICAL NO.10** | **Diffraction as a Particular Case of Interference** | **2 HOURS** |
| Calculation of wavelength of different colors using a white light. | | |
| **PRACTICAL NO.11** | **Malus' Law** | **2 HOURS** |
| Verification of Malus' law under experimental conditions. | | |
| **PRACTICAL NO.12** | **Brewster's Law** | **2 HOURS** |
| Determination of refractive index of given unknown material. | | |
| **Hands-on Activity No.1** | **Wave/ Quantum mechanics: Effect of measure- ment on the state of an observable** | **4 HOURS** |
| Measuring the change in state of an observable using Malus' law under experimental conditions. | | |
| **Hands-on Activity No.2** | **Significant digits in experimental result** | **2 HOURS** |
| Number of significant digits in the obtained result as a function of different methods used to determine a physical variable/ observable. | | |

**TEXT BOOKS**

Worsnop B.L., Flint H.T. (2002). Advanced practical Physics for students. Methuen & Co. Ltd. https://archive.org/details/in.ernet.dli.2015.86393/page/n7/mode/2up.

Ghatak A. (2021). The ten most beautiful experiments in science. (1st edition). Viva Books.

**REFERENCE BOOKS**

Worsnop B.L., Flint H.T. (2002). Advanced practical Physics for students. Methuen & Co. Ltd. https://archive.org/details/in.ernet.dli.2015.86393/page/n7/mode/2up.

Ghatak A. (2021). The ten most beautiful experiments in science. (1st edition). Viva Books.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Electrical and Electronics Engineering |
| | COURSE CODE | 2307101T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307101T.CEO.1: To impart knowledge of single-phase and three-phase AC circuits.
2307101T.CEO.2: To get acquainted with different electrical machines.
2307101T.CEO.3: To familiarize with blocks of DC power supply and BJT operation.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2307101T.CO.1: Illustrate Single Phase and three phase Systems [L2].
2307101T.CO.2: Identify electrical machines used in typical domestic and industrial Application [L3].
2307101T.CO.3: Construct analog circuits using suitable components [L3].

**COURSE ABSTRACT:**

This course focuses on developing important technical concepts in a comprehensible, coherent and rigorous way. This comprehensive course provides students with a solid foundation in the principles, theories and practical applications of Electrical and Electronics Engineering. Students will delve into the fundamental concepts of electrical circuits, power analysis, semiconductor devices and digital electronics. Students will also explore the intricate world of semiconductor devices including diodes, transistors, power supply design and uncover their applications in electronic circuits.

| **THEORY COURSE CONTENT** | | |
|---|---|---|
| **UNIT 1** | **Single Phase Electrical Systems** | **6 HOURS** |
| **Contents:** Introduction to basic Electrical elements, AC fundamentals, Series and Parallel AC circuits, Power ratings of home appliances (fan, tube light, mixer etc), Study of Electrical connection of house, Fuse, MCBs and grounding for safety at home.<br>**Activity:** Energy Consumption calculation for your Home<br>**Self Study:** 1.To study Ohms Law, KCL-KVL 2.Use of Basic Electrical Elements in house | | |
| **UNIT 2** | **Three Phase Electrical Systems** | **5 HOURS** |
| **Contents:** Introduction to Three Phase systems, Delta and Star connections, Relation between line and phase quantities (with Phasor Diagrams), Power in three phase circuits for Star and Delta connections, Introduction to Indian Power system<br>**Activity:** Overview of Indian Power Scenario- Flipped Classroom<br>**Self Study:** Selections of Star and Delta Connections as per load requirements | | |
| **UNIT 3** | **Electrical Machines** | **06 HOURS** |
| **Contents:** Single Phase Transformers: Construction, Types, Working Principle, EMF equation, Effi- ciency<br>DC Motor: Construction, Working principle, Types of DC Motors, Torque-speed characteristics<br>**Activity:** Study of Motors used in Various applications-Mind map<br>**Self Study:** Basics of PMDC, BLDC, Stepper motor, Single Phase AC Motors | | |
| **UNIT 4** | **Analog Electronics and Power Supply Design** | **06 HOURS** |
| **Contents:** Diode, Clipper circuits, Rectifier circuits, DC Regulated power supply, BJT: Construction, Configurations, DC Load Line, Q-point, Switch and Amplifier<br>**Activity:** Build and Simulate standard circuit using any Mobile application<br>**Self Study:** Study of Clamper Circuit | | |

| UNIT 5 | Digital Systems | 7 HOURS |
|---|---|---|

**Contents:** Number systems, Logic gates, SOP, K-Map, Combinational circuits: Adder, Subtractor, Mux, Code converter, Sequential circuit: Flip-Flops, Register

**Activity:** K-Map Puzzle

**Self Study:**

1- Programmable Logic Devices (PLDs)

2- Digital Circuit Simulators

**TEXT BOOKS**


Edward Hughes (2011) *"Electrical and Electronic Technology"* , 10th edition, Pearson India, ISBN- 13: 978-8131733660

Thomas L. Floyd (2018) *"Electronics Devices"*, 10th edition, Pearson Education India, ISBN-13: 978-1292222998

A. Anand Kumar (2016) *"Fundamentals of Digital Circuits"*, 4th edition, Prentice Hall of India, ISBN-13: 978-8120352681


**REFERENCE BOOKS**


V. N. Mittle and Arvind Mittal (2005). *"Basic Electrical Engineering"*, 2nd edition, McGraw Hill Education, ISBN-13: 978-0070593572

D. P. Kothari,I.J.Nagrath (2010). *"Electric Machines"*, 4th edition, McGraw Hill. ISBN: 978-0070699670.

Paul Horowitz, Winfield Hill *"The Art of Electronics"*, 3rd edition,Cambridge University press, ISBN: 978-0521809269


**E-RESOURCES**

1. *"https : //www.google.com/url?q = https : //onlinecourses.nptel.ac.in/noc25ee04/preview&sa = D&source = editors&ust = 1734508653203993&usg = AOvV aw3ChhKg2vV 4RC2sK – sKhDWM "*

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Electrical and Electronics Engineering Lab |
| | COURSE CODE | 2307101L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2307101L.CEO.1: To relate truth tables and logic expressions for various digital application.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2307101L.CO.1: Make use of OC and SC Test on Transformer to predict its efficiency at various Loading conditions [L3].

2307101L.CO.2: Illustrate applications of BJT in terms of Switch and Amplifier [L2].

2307101L.CO.3: Develop adder circuits using suitable ICs [L3].

**COURSE ABSTRACT:**

The course Electrical and Electronics Engineering combines theory with hands on laboratory experi- ments where students will have the opportunity to construct and test electronics circuits and work with real world electrical devices.

| **PRACTICALS** | | |
|---|---|---|
| **SESSION NO. 1** | **Overview in First Session** | **2 HOURS** |
| a. Three phase voltage generation and its waveform<br>b. General structure of Electrical Power System, three phase 4-wire system (introductory approach)<br>c. Safety measures in electrical system, benefits of energy conservation<br>d. Introduction to DMM, Dimmer stat / Variac, CRO/DSO, Function generator<br>e. Introduction to breadboard and its working | | |
| **PRACTICAL NO. 1** | **R-L-C series A.C. Circuit** | **2 HOURS** |
| a. To calculate exact values of R, L and C for variations in XL and XC (2 cases)<br>b. To justify the lagging and Leading nature for any two cases | | |
| **PRACTICAL NO. 2** | **Verification of relation between Line and Phase quan- tities in Star and Delta circuits** | **4 HOURS** |
| a. To understand Line, Phase quantities and types of connections in Three phase supply<br>b. To connect Bulb load in Star and Delta connection to verify the relation between Line and Phase Quantities<br>**Activity 01: A.C. Circuit Analysis:** To demonstrate concepts like phase, frequency and peak-to- peak voltage on CRO/DSO | | |
| **PRACTICAL NO. 3** | **Open circuit and Short circuit test on a Single-Phase transformer** | **2 HOURS** |
| a. To find iron losses and no-load circuit parameters<br>b. To find full load copper losses and Equivalent circuit parameters<br>c. To determine efficiency and regulation of transformers at various different loading conditions<br>**Activity 02: Simple DC Motor Model:**<br>a. Build a basic model of DC Motor using coil of wire, a magnet and a battery<br>b. Make the coil to rotate (Apply concept of Magnetic field and current) | | |

| PRACTICAL NO.4 | DC Regulated Power Supply | 4 HOURS |
|---|---|---|
| a. To design Half and Full Wave Rectifier Circuits by using breadboard<br>b. To understand 12V/ 9V/ 5V IC based DC regulated power supply (Theoretically) with Datasheets<br>c. To test and observe waveforms at various stages on CRO and measure the voltage using DMM | | |
| **PRACTICAL NO.5** | **BJT as a switch and Amplifier** | **4 HOURS** |
| a. BJT as a switch – On/Off the LED at the output by switching BJT<br>b. BJT as an Amplifier – Measure voltages and observe waveforms at input and output of the single stage CE amplifier<br>**Activity 03: Diode Application:** Design Rectifier Circuits (HWR/FWR) on breadboard | | |
| **PRACTICAL NO.6** | **Logic Gates** | **4 HOURS** |
| To study and verify truth tables of Logic Gates (AND/OR/NAND/NOR) | | |
| **PRACTICAL NO.7** | **Combinational Circuits** | **4 HOURS** |
| a. To design and implement half adder and Full adder<br>b. To design and implement Full Adder by dual 4:1 MUX (IC-74LS153) and verify truth table | | |
| **PRACTICAL NO.8** | **Sequential Circuits (Flip Flops)** | **4 HOURS** |
| To verify Truth table of flip-flops practically using ICs<br>**Activity 04: Boolean Expressions:** Implementation and verification of Boolean Expression on breadboard | | |

**TEXT BOOKS**


Edward Hughes (2011) *"Electrical and Electronic Technology"* , 10th edition, Pearson India, ISBN- 13: 978-8131733660

Thomas L. Floyd (2018) *"Electronics Devices"*, 10th edition, Pearson Education India, ISBN-13: 978-1292222998

A. Anand Kumar (2016) *"Fundamentals of Digital Circuits"*, 4th edition, Prentice Hall of India, ISBN-13: 978-8120352681


**E-RESOURCES**

https://asnm-iitkgp.vlabs.ac.in/exp/rlc-circuit-analysis/simulation.html

https://de-iitr.vlabs.ac.in/List

https://www.falstad.com/circuit/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Essentials of Data Science |
| | COURSE CODE | 2303101T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PRE-REQUISITE :**

**COURSE OBJECTIVES :**

2303101T.CEO.1: To get familiar with the basics of Python programming. 2303101T.CEO.2: To learn different data structures in Data Science.

2303101T.CEO.3: To use data computation methods in Data Science. 2303101T.CEO.4: To introduce data manipulation methods in Data Science.

2303101T.CEO.5: To use data visualization methods in Data Science.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2303101T.CO.1: Build a python program for handling syntax and semantics for any given problem[L3].

2303101T.CO.2: Demonstrate proficiency in handling data structures useful in Data Science[L3].

2303101T.CO.3: Apply the suitable methods of data computations on real time data[L3].

2303101T.CO.4: Interpret the different methods of data manipulation on real time data[L3].

2303101T.CO.5: Apply data visualization for real time data to get better insights[L3].

**COURSE ABSTRACT**

Essentials of Data Science (EDS) is the First Year Semester-II course. This course aims at equipping learners to be able to provide the essence of Data Science by using python programming. In this course, firstly, the learners will learn python fundamentals required for Data Science. The learners are able to use different data organizational structures to store the real time data. Data computations are required to maintain the quality of data. EDS helps to learn different data computations. Data manipulations help in handling missing and noisy values in Data Processing. The learner will learn data storing, loading, cleaning, preparation, wrangling, transformation etc. Data visualization is the practice of translating information into a visual context, such as a map or graph which tends to identify the patterns, trends from the data. This course will increase the learner's interest in Data Science. The activity based learning is adapted to learn this course.

**THEORY COURSE CONTENT**

| UNIT 1 | Python Fundamentals for Data Science | 6 HOURS |
|---|---|---|

**App/System/Case study:**Weather Analysis

**Contents:**Introduction, Data Types- Mutable and immutable types, Data Conditioning using Decision Statements and Iterative Statements.
Functions: Basics of functions, variable scope and lifetime, Lambda or anonymous function. Modules: Introduction to modules, packages and standard library modules.
Data Handling using Files.

**Self Study:**CSV Reader and Writer

**Further Reading:**Excel Reader and Writer

| UNIT 2 | Data Organizational Structures | 6 HOURS |
|---|---|---|

**App/System/Case study:**Retail-Industry/Twitter Reviews

**Contents:**Categories of Data- Unstructured, Structured, Categorical and Time Series List- Creating List, List operations
Tuple- List of Tuples, Immutability,

Dictionaries- Creating Dictionary, Adding to Dictionary with SetDefault, Loading JSON to Dictionary Set- Removing Data from Sequences, Performing common data set operation

**Self Study:**JSON File Handling

**Further Reading:**XML File Handling

| UNIT 3 | Data Computation | 6 HOURS |
|---|---|---|

**App/System/Case study:**Stock Market

**Contents:**Data Operations- Arithmetic and Statistical, Bitwise Operators, Linear Algebra, Copying and viewing data in arrays, Stacking, Data Sorting, Data Searching and Indexing, Data counting, Mathematical Operations, Broadcasting, Matrix Operations, Structured Data.

**Self Study:**Fancy Indexing

**Further Reading:**Parallel Processing using Arrays

| UNIT 4 | Data Manipulation | 6 HOURS |
|---|---|---|

**App/System/Case study:**Salary Analysis

**Contents:**Data Loading, Data Storage, Summarizing and Computing Descriptive Statistics, Data Cleaning, Data Preparation, And Data Wrangling: Join, Combine, and Reshape, Data Transformation, Data Aggregation and Group Operations.

**Self Study:**Working on XML and JSON

**Further Reading:**Data Profiling

| UNIT 5 | Data Distribution and Visualization | 6 HOURS |
|---|---|---|

**App/System/Case study:**Sales

**Contents:**Population and Samples

Data Distribution- Statistical Analysis of Data, Data Analytics Techniques; Descriptive, Predictive and Prescriptive, Normal Distribution Significance of Data Visualization in Data Science, Plots- Line Chart, Bar Plot, Histogram, Scatter Plot, Pie Chart, Density Plot, Facet Grids for categorical data, Group Plots

**Self Study:** 3D Visualizations

**Further Reading:**Supervised Learning - Classification-KNN, Regression-Simple Linear Regression

**TEXT BOOK**


VanderPlas, J. (2016). Python data science handbook: Essential tools for working with data. ” O’Reilly Media, Inc.”.

McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. ” O’Reilly Media, Inc.”.

McKinney, W. (2017). Python for data analysis, ” O’Reilly Media, Inc”.

Brownley, C. W. (2016). Foundations for Analytics with Python: From Non-Programmer to Hacker. ” O’Reilly Media, Inc.”

**REFERENCE BOOK**

Mueller, J. P., & Massaron, L. (2019). Python for data science for dummies. John Wiley & Sons.

Grus, J. (2019). Data science from scratch: first principles with python. O'Reilly Media.

Kane, F. (2017). Hands-on data science and python machine learning. Packt Publishing

**E-RESOURCES**

1. *https* : *//onlinecourses.nptel.ac.in/noc*22*cs*32*/preview*

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Essentials of Data Science Lab |
| | COURSE CODE | 2303101L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE :**

**COURSE OBJECTIVES :**

2303101L.CEO.1: To get familiar with the basics of Python programming. 2303101L.CEO.2: To learn different data structures in Data Science.

2303101L.CEO.3: To use data computation methods in Data Science. 2303101L.CEO.4: To introduce data manipulation methods in Data Science.

2303101L.CEO.5: To use data visualization methods in Data Science.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2303101L.CO.1: Build a python program for handling syntax and semantics for any given problem[L3].

2303101L.CO.2: Demonstrate proficiency in handling data structures useful in Data Science[L3].

2303101L.CO.3: Apply the suitable methods of data computations on real time data[L3].

2303101L.CO.4: Interpret the different methods of data manipulation on real time data[L3].

2303101L.CO.5: Apply data visualization for real time data to get better insights[L3].

**COURSE ABSTRACT**

Essentials of Data Science (EDS) is the First Year Semester-II course. This course aims at equipping learners to be able to provide the essence of Data Science by using python programming. In this course, firstly, the learners will learn python fundamentals required for Data Science. The learners are able to use different data organizational structures to store the real time data. Data computations are required to maintain the quality of data. EDS helps to learn different data computations. Data manipulations help in handling missing and noisy values in Data Processing. The learner will learn data storing, loading, cleaning, preparation, wrangling, transformation etc. Data visualization is the practice of translating information into a visual context, such as a map or graph which tends to identify the patterns, trends from the data. This course will increase the learner's interest in Data Science. The activity based learning is adapted to learn this course.

**PRACTICAL:Perform following experiments using python programming language.**

| **PRACTICAL NO.01** | | **6 HOURS** |
|---|---|---|

**Practice Lab Assignments:**

1. To accept an object mass in kilograms and velocity in meters per second and display its momentum. Momentum is calculated as e=mc2 where m is the mass of the object and c is its velocity.
2. Write a Python program for following conditions.

   If n is single digit print square of it.

   If n is two digit print square root of it.

   If n is three digit print cube root of it.
3. Read the birth date and salary in rupees of employees. Perform data transformation for birthdate to age and also salary which is in rupees to salary in dollars using functions.
4. Print the reverse number of a given number,

**Lab Assignment:**

1. To accept students five courses marks and compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course.
If student scores aggregate greater than 75 percentage, then the grade is distinction.
If aggregate is greater than or equal to 60 and less than 75 then the grade if first division. If aggregate is greater than or equal 50 and less than 60, then the grade is second division. If aggregate is greater than or equal 40 and less than 50, then the grade is third division.
2. Solve the Fibonacci sequence using recursive function in Python.
3. Write a Python program to print different patterns.

**Self Study Assignment:**

Perform all statistical analysis (Average, Max, Min, Sum, on emplyoee data.

| PRACTICAL NO.02 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Perform all List Operations, Dictionary Operations.

**Lab Assignment:**

1. Select the number from the entered list and find its position in Python (use Linear Search).
2. Choose cricket team of eleven players find the captain of the team (consider tallest person as a captain) using dictionary.

**Self Study Assignment:** 1. Consider the student subjects marks are stored in the list. Find the total marks and percentage of students.
2. Perform all tuple operations.

| PRACTICAL NO.03 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Perform all the Numpy operations in python.

**Lab Assignment:**

Prepare/Take dataset for any real life application. Read a dataset into an array. Perform following operations on it as:
- Perform all matrix operations
- Horizontal and vertical stacking of Numpy Arrays
- Custom sequence generation
- Arithmetic and Statistical Operations, Mathematical Operations, Bitwise Operators
- Copying and viewing arrays
- Data Stacking, Searching, Sorting, Counting, Broadcasting

**Self Study Assignment:** For any real life application, perform advanced data operations such as image as array and image manipulations.

| PRACTICAL NO.04 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Perform all the pandas operations in python.

**Lab Assignment:** Read any real life dataset. Store the data into Data Frames. Identify 10 grains for the given dataset. Implement all 20 grains using Pandas methods. The Sample Grains for Sales Dataset as:
- Which was the best month for sales? How much was earned that month?
- Which product sold the most? Why do you think it did?
- Which city sold the most products?
- What Products are most often sold together?

**Self Study Assignment:** For any real life application, perform advanced Data Manipulation opera- tions such as combining data, handling time series data.

| PRACTICAL NO.05 | | 6 HOURS |
|---|---|---|

**Practice Lab Assignment:**

1. Install MatPlotLib library. Draw basic graphs for sales dataset using MatPlotLib.

**Lab Assignment:**

For Titanic dataset, Perform data analysis. Identify 5 grains for a given dataset. Perform a data visualization for those grains using the MatPlotLib library. (Use any 5 different graphs with proper title, legends, axis names, etc.to map identified grains)

**Self Study Assignment:** 1. For any real life application, perform advanced graphs for data visu- alization such as Span Selector, Broken Barh-Broken Horizontal Bar plot, Watermarking Images with Matplotlib.

2. Apply Linear Regression and K-Nearest Neighbour Classifier on a real time dataset.

**TEXT BOOK**


VanderPlas, J. (2016). Python data science handbook: Essential tools for working with data. " O'Reilly Media, Inc.".

McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".

McKinney, W. (2017). Python for data analysis, " O'Reilly Media, Inc".

Brownley, C. W. (2016). Foundations for Analytics with Python: From Non-Programmer to Hacker. " O'Reilly Media, Inc."


**REFERENCE BOOK**


Mueller, J. P., & Massaron, L. (2019). Python for data science for dummies. John Wiley & Sons.

Grus, J. (2019). Data science from scratch: first principles with python. O'Reilly Media.

Kane, F. (2017). Hands-on data science and python machine learning. Packt Publishing


| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY (AI-ML) | COURSE NAME | DATA VISUALIZATION |
| | COURSE CODE | 2311162T |
| | COURSE CREDITS | 1 |

| RELEASE DATE : | REVISION NO. | |
|---|---|---|

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 1 | NIL | 15 | NIL | 20 | NIL | NIL | 35 |

**COURSE OBJECTIVES :**

2311162T.CEO.1: To introduce students to the fundamental problems, concepts, and approaches in the design and analysis of data visualization systems

2311162T.CEO.2: To familiarize students with the stages of the visualization pipeline, visualization paradigms,techniques, and tools.

2311162T.CEO.3: To Design effective data visualizations in order to provide new insights and commu- nicate information to the viewer.

2311162T.CEO.4: To implement the effectiveness of visualizations for specific data, task, and user types.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311162T.CO.1: Apply Data Exploration, Profiling techniques, cleaning tables on given dataset [L3].

2311162T.CO.2: Identify grains for the given domain [L3].

2311162T.CO.3: Choose appropriate graphs for given grains [L3].

2311162T.CO.4: Construct dashboard and story boards [L3].

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **DATA EXPLORATION** | **06 HOURS** |
| **Applications/Case Study: North wind dataset**<br>**Contents:** Data visualization fundamentals, need for data visualization, Data Exploration, Data profiling, Preprocessing tables and data cleaning, Importance dynamic dashboard, Significance & amp; applications of each graph illustrate with example. | | |
| **UNIT 2** | **DATA ANALYSIS AND VIEW ENHANCEMENT** | **05 HOURS** |
| **Applications/Case Study: Titanic data set**<br>**Contents:** table calculations,Format worksheet: Font setting, Border, Line, Format specific setting: Number, Field labels, Annotation: Add and Mark, Positioning, Area, Format, Remove, Labels: Display, Show and hide individual mark label, move label. Descriptive analysis and its co-copyrightResize table: Resize entire table, Rows, columns, Cells. | | |
| **UNIT 3** | **DASHBOARD AND STORY BOARD** | **04 HOURS** |
| **Applications/Case Study: Football tournament data set**<br>**Contents:** Significance and application of each graph, Descriptive analysis and its significance. | | |

**Text book**

1. Sharada Sringeswara; Purvi Tiwari; U. Dinesh Kumar, (2022),"Data Visualization: Storytelling Using Data", Wiley Publication.

**REFERENCE BOOKS**

Appala Srinuvasu Muttipati, (2023), " Hand Book on Data Visualization: Easy to quick prac- tices", Notion Press, ISBN: 9798891862920.

Joshua N.Milligan. (2015), "Learning Tableau 2020", Packt Publication Limited, ISBN-978-1784391164.

**E - Resources**

1. https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | DATA VISUALIZATION LAB |
| | COURSE CODE | 2311162L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 20 | 40 |

**COURSE OBJECTIVES :**

2311162L.CEO.1: To introduce students to the fundamental problems, concepts, and approaches in the design and analysis of data visualization systems

2311162L.CEO.2: To familiarize students with the stages of the visualization pipeline, visualization paradigms,techniques, and tools.

2311162L.CEO.3: To Design effective data visualizations in order to provide new insights and commu- nicate information to the viewer.

2311162L.CEO.4: To implement the effectiveness of visualizations for specific data, task, and user types.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311162L.CO.1: Apply Data Exploration, Profiling techniques, cleaning tables on given dataset [L3].

2311162L.CO.2: Identify grains for the given domain [L3].

2311162L.CO.3: Choose appropriate graphs for given grains [L3].

2311162L.CO.4: Construct dashboard and story boards [L3].

| **PRACTICALS** | | |
|---|---|---|
| PRACTICAL NO.01 | Implement Data connection for the given case study. | **2 HOURS** |
| - | | |
| PRACTICAL NO.02 | Identification of grains for any given application/case study e.g Walmart /supermarket for analysis. | **2 HOURS** |
| . | | |
| PRACTICAL NO.03 | Concepts and demonstration: Implement data management for enhancing customer experience through<br>1. Filter Addition<br>2. Quick Filters<br>3. Global Filters<br>4. Context Filters<br>5. Sorting<br>6. Grouping | **2 HOURS** |
| . | | |
| **PRACTICAL NO.04** | **Concepts and demonstration: Construct View based on the geographical data visualization with the help of**<br>1. Toolbar<br>2. Dimensions and Measures field<br>3. Folders | **2 HOURS** |
| . | | |

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **Discover basic and advanced view types using**<br>1. Pie charts<br>2. Stacked bar charts<br>3. Histogram<br>4. Line chart<br>5. Area chart<br>6. Scatter plot<br>7. Box and Whisker plot<br>8. Bullet chart<br>9. geographical data charts<br>10. geospatial charts<br>11. tree charts<br>12. heat maps<br>13. pareto charts | **4 HOURS** |
| . | | |
| **PRACTICAL NO.06** | **Concepts and demonstration: Table calculations and measures**<br>1. Addressing and Partitioning table calculations<br>2. Quick table calculations<br>3. Custom table calculations<br>4. Creation of calculated filed<br>5. calculated measures | **4 HOURS** |
| - | | |

| | | |
|---|---|---|
| **PRACTICAL NO.07** | **Concepts and demonstration: create a professional dashboard and story boards by applying**<br>1. Worksheet Formatting<br>2. Format specific setting<br>3. Resize table<br>4. Copy format to other worksheet etc. | **4 HOURS** |
| **PRACTICE ANY 2** | **Concepts and demonstration: create a professional dashboard and story boards on given case study** | **10 HOURS** |

**Text book**

1. Sharada Sringeswara; Purvi Tiwari; U. Dinesh Kumar, (2022),"Data Visualization: Storytelling Using Data", Wiley Publication.

**REFERENCE BOOKS**

Appala Srinuvasu Muttipati, (2023), " Hand Book on Data Visualization: Easy to quick prac- tices", Notion Press, ISBN: 9798891862920.

Joshua N.Milligan. (2015), "Learning Tableau 2020", Packt Publication Limited, ISBN-978-1784391164.

**E - Resources**

1. https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial- home.htm

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Discrete Structure |
| | COURSE CODE | 2311111T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : 01/07/2024 | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**COURSE OBJECTIVES :**

2311111T.CEO.1: To learn the basics of set theory and propositional logic.

2311111T.CEO.2: To use appropriate set, function, or relation models to analyze practical examples.

2311111T.CEO.3: To apply the Model and analyze computational processes using combinatorial methods.

2311111T.CEO.4: To explore several logical possibilities and algebraic structures. 2311111T.CEO.5: To understand and solve problems on graphs and trees.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311111T.CO.1: Develop the notion of mathematical thinking, and mathematical proofs in problem analysis [L2].

2311111T.CO.2: Apply propositional logic to elementary mathematical arguments to ensure reasoning [L3].

2311111T.CO.3: Solve problems using Permutations, combinations,relations, and functions [L2].

2311111T.CO.4: Apply the concepts of graphs and trees for problem-solving [L3].

**COURSE ABSTRACT:**

The course will be an introduction to Discrete Mathematics which comprises the essentials for a computer science student to go ahead and study any other topics in the subject. The emphasis will be on problem- solving as well as proofs. The course will provide motivational illustrations and applications throughout the course. The course assumes no prerequisites except for high school-level arithmetic and algebra.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **BASIC SETS THEORY** | **06 HOURS** |
| **Applications/Case Study:** Bank Management System, Online Shopping System: Specialization and Generalization<br>**Contents:** Sets, Basic operations of sets, Finite and Infinite sets, Principle of Inclusion and exclusion, power sets, countable and uncountable sets. .<br>**Self Study:** Multi-Sets, Use of Multi Sets<br>**Further Readings:**Applications of Mathematical Induction | | |
| **UNIT 2** | **PROPOSITIONAL LOGIC** | **06 HOURS** |
| **Applications/Case Study:** Applications of Propositional Logic in AI, Logic Puzzles<br>**Contents:** Propositional Logic: logic, Propositions, Conditional Propositions, Logical Connectivity, prepositional calculus, Universal and Existential Quantifiers, and Rules of inference.<br>**Self Study:**Propositional Equivalences.<br>**Further Readings:**Application of propositional logic in Boolean Algebra, Logic Circuits. | | |
| **UNIT 3** | **RELATIONS** | **06 HOURS** |
| **Applications/Case Study:** Relation between sets and associated functions<br>**Contents:**Relations: Definition and Properties of Binary Relations, Closure of relations, Warshalls algorithm, Equivalence relations and partitions, Partial ordering relations,Hasse Diagram, and lattices, Chains and Antichains.<br>**Functions:** Functions, Surjective, Injective and Bijective functions, Composition of functions.<br>**Self Study:** Application Recurrence Relation for Analysis of Algorithm.<br>**Further Readings:**Linear Recurrence Relations with Constant Coefficients. | | |
| **UNIT 4** | **COUNTING METHODS AND THE PIGEONHOLE PRINCI- PLE** | **06 HOURS** |
| **Applications/Case Study:** Library Management System, Diet Planning System<br>**Contents:** The Basics of Counting, rule of Sum and Product, Permutations and Combinations , Binomial Coefficients and Combinatorial Identities, and pigeonhole principle.<br>**Self Study:** Algorithms for generating Permutations and Combinations..<br>**Further Readings:**Discrete Probability Theory. | | |

| UNIT 5 | ALGEBRAIC STRUCTURES | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Cryptography

**Contents:** Groups theory: Algebraic Systems, Groups, Semi-Groups, Monoids, Subgroups, Permuta- tion Groups, Codes and Group codes, Isomorphism and Auto-morphisms, Homomorphism.

**Self Study:** Euclidean algorithm.

**Further Readings:**Abelian and cyclic groups.

**TEXT BOOKS**


1. R. Johnsonbaugh (2009). *Discrete Mathematics*. $5^{th}$ Edition, Pearson Education, ISBN 817808279- 9 C.

Liu and D. P. Mohapatra (2008). *Elements of Discrete Mathematics*. $6^{th}$ TataMcGraw-Hill,ISBN 10:0-07-066913-9

Kenneth H. Rosen (2007). *Discrete Mathematics and its Applications*. $6^{th}$ McGraw-Hill, ISBN 978-0-07-288008-3


**REFERENCE BOOKS**


N. Biggs (2002). *Discrete Mathematics*. $3^{rd}$ Edition, Oxford University Press.

E. Goodaire and M. Parmenter *Discrete Mathematics with Graph Theory*. $2^{nd}$ Edition, Pearson Education.

Semyour Lipschutz Marc Lipson *Discrete Mathematics*. $3^{rd}$ Edition, McGraw-Hill.

B. Kolman, R. Busby and S. Ross *Discrete Mathematical Structures*. $4^{th}$ Edition, Pearson Education.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (English) Lab |
| | COURSE CODE | 2301111L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301111L.CEO.1: To explain the sounds in English and introduce phonemic transcription. 2301111L.CEO.2: To illustrate the application of fundamental English grammar.

2301111L.CEO.3: To strengthen listening and reading skills with the use of audio and visual aids.

2301111L.CEO.4: To extend the appropriateness of the writing skills in English.

2301111L.CEO.5: To prepare advanced presentations using Canva.

2301111L.CEO.6: To improve communicative competence in English.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301111L.CO.1: Make use of the sounds of English accurately [L3]. 2301111L.CO.2: Apply English grammar rules precisely in practical situations [L3]. 2301111L.CO.3: Build vocabulary and listening skills using audio-visual aids [L3]. 2301111L.CO.4: Develop syntax and texts in English coherently and formally [L3]. 2301111L.CO.5: Utilise Canva to improve presentation skills professionally [L3].

2301111L.CO.6: To enhance communicative competence in English [L3].

**COURSE ABSTRACT**

The course ”Communication Skills: English” primarily focuses on developing communication skills through practical application and utilising language abilities. The objective is to achieve this goal by employing efficient communication and maintaining a constructive demeanour. Students are encouraged to use English as a communication skill to understand speech and body language nuances. This is achieved through activity-based methods and approaches in the language laboratories. The training programme facilitates students' persuasive skills development while fostering improved interpersonal relationships through effective verbal communication. The course enhances students' proficiency and accuracy in communicative competence in English. It enables them to effectively communicate in various contexts, such as society, higher education, and the professional workforce. The course also trains students in using proper practical grammar to enhance effective articulation in English, exploring the primary factors and variables contributing to their difficulties in oral proficiency.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Pronunciation and Phonemic Transcription** | **4 HOURS** |
| Identification of correct pronunciation of words by decoding phonemic scripts; writing phonemic tran- scriptions of the given words. | | |
| **PRACTICAL NO.02** | **Tense and Common Errors** | **6 HOURS** |
| Use of tenses in day to day communication and academic writing. | | |
| **PRACTICAL NO.03** | **Listening Skills** | **4 HOURS** |
| Active listening; Conversations, audio and video clips; Listening with comprehension. | | |
| **PRACTICAL NO.04** | **Vocabulory Enrichment** | **4 HOURS** |
| Online exercises on AWL and NAWL using web-based applications; Dictionary Skills and Common errors in grammar while speaking and writing English. | | |
| **PRACTICAL NO.05** | **Resume, Cover Letter and Email Writing** | **4 HOURS** |
| How to write an email, characteristics and essentials of a good email, resume, formal letter writing and layout of business letters . | | |
| **PRACTICAL NO.06** | **Essay Writing** | **4 HOURS** |
| What is an essay? Tips to write a good essay, Types of essays. | | |
| **PRACTICAL NO.07** | **Report Writing** | **4 HOURS** |
| Types of reports, format and writing a report, what is summarizing? Rules of summarizing. | | |

| PRACTICAL NO.08 | Presentation Skills-Canva | 6 HOURS |
|---|---|---|
| Essentials of effective presentations; Data collection and compilation; Preparation of outlines. | | |
| **PRACTICAL NO.09** | **Group Discussions** | **4 HOURS** |
| Concept of GD, Criteria for evaluation, types of GD – General, Creative and Technical, Dos and Don'ts, Guidelines for participation and success, Group Dynamics, Expression of thoughts and ideas, body language and interpersonal and analytical skills. | | |
| **PRACTICAL NO.10** | **Role Play** | **4 HOURS** |
| Role-play for verbal communication, team building and group dynamics, decision making, leadership, analytical and creative thinking, group presentation. | | |
| **PRACTICAL NO.11** | **Debate** | **4 HOURS** |
| Concept, Dos and Don'ts, Guidelines for participation and success, Expression of thoughts and ideas, body language and interpersonal and analytical skills. | | |
| **PRACTICAL NO.12** | **Persuasive Speaking** | **6 HOURS** |
| Attributes of a good public speaker; prepared and extemporaneous speech; Listening and Reading to famous speeches. | | |
| **PRACTICAL NO.13** | **Reading Comprehension** | **6 HOURS** |
| Techniques of reading- Intensive, Extensive, Skimming and Scanning; Reading Comprehensions. | | |

**REFERENCE BOOKS**


Ashok Thorat and Munira Lokhandwala: Enriching Oral and Written Communication in English, ISBN 9788125037446.

Swan, M. (2005). Practical english usage (Vol. 688). Oxford: Oxford university press.

Dutt et.al. : A Course in Communication Skills, Foundation, 1 edition.

Peter Roach: English Phonetics and Phonology, 4th Edition, Cambridge, ISBN-0521149215.

Lynch: Listening, Cambridge, 1st edition, ISBN- 0521707757.

Malcom Goodale: Professional Presentations, Cambridge, ISBN- 8175962577.

Aggarwal, S. (2009). Essential communication skills. Ane Books Pvt Ltd.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (German) |
| | COURSE CODE | 2301112T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301112T.CEO.1: To introduce German language and enhance knowledge, communication and intel- lectual capabilities.

2301112T.CEO.2: To extend the appropriateness of writing and speaking skills. 2301112T.CEO.3: To develop ability to respond to simple questions in the German language. 2301112T.CEO.4: To acquire basic vocabulary about daily topics.

2301112T.CEO.5: To improve communicative competence in German.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301112T.CO.1: Apply the foundational aspects of grammar and memorize vocabulary [L3]. 2301112T.CO.2: Develop comprehension of low to medium difficulty text and practice speaking about every day basic topics [L3].

2301112T.CO.3: Build the basic communication and comprehension skills for conducting day to day business effectively [L3].

2301112T.CO.4: Make use of simple, familiar expressions to interact with native speakers [L3].

2301112T.CO.5: Develop communicative competence in German language [L3].

**COURSE ABSTRACT**

The German course not only gives students an excellent grounding in the language, but also opens up fascinating chances to learn more about German culture, history, and literature. Students develop the foundational skills and more advanced strategies necessary to function in a German -speaking culture. A broad variety of linguistic skills, from being able to express oneself properly in writing and speech to being able to understand different forms and talk convincingly in front of an audience of any size, may be honed by learning the language from the bottom up. You may start from scratch with a new language or build on what you already know in this course. Formal education consists of classroom instruction like lectures, seminars, and tutorials. Additionally, students study German through the lens of linked subjects in the fields of history, language, culture, and religion. This German language course is intended for individuals with a high level of linguistic proficiency who want to either deepen their knowledge of the language or begin learning it from scratch.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **Introduction and History** | **2 HOURS** |
| **Contents:**Information about Germany, German History, Culture and Language.<br>**Self Study:** Historical perspectives of German language . | | |
| **UNIT 2** | **Greetings and Introduction** | **4 HOURS** |
| **Contents:** Related Vocabulary Alphabets, Numbers, Countries, Languages, Email-Adress, Phone number, Grammar: W-Questions, Simple Sentences, Verb conjugation and personal pronouns like (I, You, He/She/It, We etc.).<br>**Self Study:** Word Formation. | | |
| **UNIT 3** | **Speaking about hobbys, Making an Appointment, Profile in Internet** | **4 HOURS** |
| **Contents:** Numbers (continued), Activity verbs, regular and irregular verbs, Weekdays, Months, Seasons, Professions, Grammar: articles (der, die, das, die) and yes-no-questions.<br>**Self Study:** Oral conversation. | | |
| **UNIT 4** | **City and Sightseeing** | **6 HOURS** |
| **Contents:**Talking about places in a city (railway station, market, bus stop, mall, theatre, cinema hall, museums etc.), Transport (train, bus, plane, tram, metro), Asking for an address or directions, Comprehension: reading city map and events calendar, Grammar: articles in negation (kein, keine, kein, keine), Imperative sentences with you.<br>**Self Study:** Regional information in Germany. | | |
| **UNIT 5** | **Food** | **4 HOURS** |
| **Contents:**Fruits, Vegetables, Drinks, Meals, shops, Grocery shopping, Grammar: Accusative case. | | |

| |
|---|
| **Self Study:** Cultural Food in Germany. |

| UNIT 6 | Time | 6 HOURS |
|---|---|---|
| **Applications/Case Study:**German Translation.<br>**Contents:**Talking about time, asking for time, Making an appointment (part 2), Daily routine, Tele- phone and email conversations, Grammar: Modalverbs, posessive articles (my, your. . . ).<br>**Self Study:** Time keeping formats. | | |
| **UNIT 7** | **Revision** | **4 HOURS** |
| **Applications/Case Study:** German Translation.<br>**Contents:** Reading and comprehension, Writing, Listening (optional), Speaking. | | |

**TEXT BOOKS**

1. Netzwerk Deutsch als Fremdsprache- Kursbuch A1( Stefanie Dengler), Goyal Publications.

**REFERENCE BOOKS**

1. https://www.klett-sprachen.de , https://www.duolingo.com/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (Japanese) |
| | COURSE CODE | 2301113T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301113T.CEO.1: To introduce Japanese as a foreign language and enhance knowledge, communication and intellectual capabilities which helps to improve cognitive skills and creativity vital for problem solving and innovation.
2301113T.CEO.2: To develop an awareness of Japanese culture along with providing better career opportunities later in life.
2301113T.CEO.3: To develop ability to respond to simple questions in the Japanese language. 2301113T.CEO.4: To acquire basic vocabulary about daily topics in Japanese language.
2301113T.CEO.5: To develop skills related to reading simple sentences and understanding uncompli- cated dialogues.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301113T.CO.1: Develop communication and comprehension skills for conducting day-to-day business effectively
2301113T.CO.2: Understand typical every day and job-related expressions and sentences in the written format.
2301113T.CO.3: Use simple, familiar expressions and produce main ideas of familiar topics when in- teracting with native speakers or when visiting Japan.
2301113T.CO.4: Develop basic terminology regarding everyday themes in Japanese.
2301113T.CO.5: Hone abilities in reading easy-to-follow words and comprehending straightforward conversations.

**COURSE ABSTRACT**

Learning Japanese gives students a firm grasps of the language as well as a window into Japanese society, history, and literature. Students acquire both the basic and advanced skills necessary to function effectively in a Japanese-speaking culture. Starting from scratch with a language is the best way to develop fluency in all aspects of communication, from reading and writing to speaking in front of large groups with ease. The course is designed to help students learn a new language and improve their existing skills. To acquire knowledge, students participate in classroom activities such as lectures, seminars, and tutorials. In addition, they study Japan and its culture from a variety of angles, including its history, language, culture, and religion. This course is intended with a high level of linguistic proficiency who wants to either expand their knowledge of Japanese or begin learning it from scratch.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **Introduction** | **3 HOURS** |
| **Contents:** Information about Japan, Japanese History, Culture and Language.<br>**Self Study:** Japanese Background . | | |
| **UNIT 2** | **Greetings, Self Introduction, Japanese Script** | **6 HOURS** |
| **Contents:**Self-Introduction- Jikoshoukai, Greeting Words, Hiragana Series, Simple vocabulary in Hi- ragana.<br>**Self Study:**Introduce yourself. | | |
| **UNIT 3** | **Understanding Japanese Script** | **4 HOURS** |
| **Contents:** Katakana Series, Simple vocabulary in Katakana, Introduction of the concept of time .<br>**Self Study:** Japanese script. | | |
| **UNIT 4** | **Understanding Simple Sentence Patterns, Time, Prices, Adjectives** | **5 HOURS** |
| **Contents:** Basic sentence pattern, Use of demonstrative pronouns, Numbers, Expressing time, Asking for / telling prices, Adjectives.<br>**Self Study:** Grammatical Components. | | |
| **UNIT 5** | **Date, Verbs, Directions, Binding Sentences** | **6 HOURS** |
| **Contents:** Dates, time, frequencies, Verbs in the present and past tense, Coming/Going to, Binding and building longer sentences.<br>**Self Study:** Binding sentences. | | |
| **UNIT 6** | **Amounts of Time/Money, Distance, Describing Existence, Counters** | **6 HOURS** |
| **Applications/Case Study:**German Translation.<br>**Contents:**Asking/Telling the amount of time and money, Going from/to, Describing the existence/non- existence of something, Counters.<br>**Self Study:** Describing existence. | | |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| FIRST YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Communication Skills (French) |
| | COURSE CODE | 2301114T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301114T.CEO.1: To introduce French language and enhance knowledge, communication and intellec- tual capabilities.

2301114T.CEO.2: To extend the appropriateness of writing and speaking skills. 2301114T.CEO.3: To develop ability to respond to simple questions in the French language. 2301114T.CEO.4: To acquire basic vocabulary about daily topics

2301114T.CEO.5: To improve communicative competence in French.

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301114T.CO.1: Apply the foundational aspects of grammar and memorize vocabulary [L3]. 2301114T.CO.2: Develop comprehension of low to medium difficulty text and practice speaking about every day basic topics [L3].

2301114T.CO.3: Build the basic communication and comprehension skills for conducting day-to-day business effectively [L3].

2301114T.CO.4: Make use of simple, familiar expressions to interact with native speakers [L3].

2301114T.CO.5: Develop communicative competence in French language [L3].

**COURSE ABSTRACT**

The French course provides students with a solid foundation in the language and opportunities to delve further into a foreign culture, history, and literature. Students learn the fundamentals and advanced techniques they need to succeed in a society where French language is spoken. Learning the language from the ground up helps hone a wide range of linguistic abilities, from expressing yourself clearly in speaking and writing to comprehending various formats to confidently address an audience of any size. The course provides with the option to learn a language from the ground up or to expand on any prior knowledge of the language. Students learn through formal training, lectures, seminars, and tutorials. In addition, they pursue a curriculum in French studies through related themes in historical, linguistic, cultural, religious, and other settings. The French course is designed for students with advanced language abilities to deepen their mastery of a foreign language or begin studying it from scratch.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **Introduction** | **5 HOURS** |
| **Contents:** Vous connaissez la France ? - Introduction.<br>**Self Study:** Spoken task -record an audio. | | |
| **UNIT 2** | **Presentation and Questioning** | **5 HOURS** |
| **Contents:** Autour de moi- Presenting and questioning Nouns.<br>**Self Study:** Written task- forming questions and exercises. | | |
| **UNIT 3** | **Syntax** | **5 HOURS** |
| **Contents:** Le monde- Sentence structure, talking about oneself, countries, cities ,etc.<br>**Self Study:** Written task- form sentences about oneself, countries, cities ,etc. | | |
| **UNIT 4** | **Speaking and Writing Skills** | **5 HOURS** |
| **Contents:**Ma famille- writing and talking about :Family, house and time.<br>**Self Study:** Written task- form sentences about one's family and house. | | |
| **UNIT 5** | **Writing Task** | **5 HOURS** |
| **Contents:** Mes loisirs- writing and talking about :Hobbies.<br>**Self Study:** Written task- form sentences using different verbs and talk about one's hobbies. | | |
| **UNIT 6** | **Spoken and Written Daily Routine** | **5 HOURS** |
| **Contents:** Ma routine- writing and talking about : daily activities, seasons and one's body.<br>**Self Study:** Written task- form sentences about one's daily routine and seasons. | | |

**REFERENCE BOOKS**

Extracts from: Alter Ego 1, En Echanges, Entre jeunes, Apprenons le franc¸ais.
Worksheets.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING** | **W.E.F** | **AY:** 2024 - 2025 |
| **FIRST YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Creative Technologies Lab |
| | **COURSE CODE** | 2307183L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : 01/07/2024** | **REVISION NO.** | 1.0 |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2307183L.CEO.1: Develop insight for Futuristic Technology Development.

2307183L.CEO.2: Become familiar with Digital Technologies like AI, AR, Block chain, Cloud, IOT

2307183L.CEO.3: Explore various developments in Robotics, EV, Drone and AE/CE, ZEB.

2307183L.CEO.4: Build a solution for real life problem based on futuristic technologies 2307183L.CEO.5: Design and Develop a Digital Portfolio using Web Technology

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2307183L.CO.1: Articulate the significance of United Nations Organization (UNO) Goals. [L2]

2307183L.CO.2: Develop a Digital Portfolio using Web Technology. [L3]

2307183L.CO.3: Illustrate the use cases of emerging technologies. [L2]

2307183L.CO.4: Develop a Laboratory project based on future technologies in a team. [L3]

**COURSE ABSTRACT**

This is compulsory course with choice-based modules aims to focus on introduction to the futuristic developing engineering technologies. The students will gain insight to technology development and multidisciplinary industrial environment at introductory level. The students will comprehend different technologies in instructional interaction. They will develop Digital portfolio using Web Technology. The students will have ample choice to select futuristic technology of their interest. In order to expe- rience joyful learning, students will apply chosen futuristic technology for real life problems. Alongside demonstrations and there will be hands on training on chosen futuristic technology. They will develop a laboratory project based on futuristic technologies Like Artificial Intelligence (AI), Generative AI (GenAI) and Prompt Engineering, Block-chain Technology, Electric Vehicles (EV), Internet of Things (IOT), Cloud Computing, Augmented Reality (AR), Robotics and Drones, Zero Energy Building (ZEB) and Affordable and Clean Energy (AE/CE).

**PRACTICALS:**

**Module 1: INSTRUCTIONAL MODULE (16 HOURS) [COMPULSORY]**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Sustainable Technology Development** | **1 HOURS** |
| Need for Technology, Overview of Technology Development. Advanced Technologies by year 2030, UNO Goals, Priorities, Open problems, Sustainable Technology.<br>**Application/Case Study:** Zero Hunger (UNO Goals: Sustainable Development Goal 2). | | |
| **PRACTICAL NO.02** | **Digital Portfolio** | **1 HOURS** |
| Significance of digital portfolio, Methods for making effective digital portfolio.<br>**Application/Case Study:** Sample Digital portfolios of students and Professionals. | | |
| **PRACTICAL NO.03** | **Futuristic Technologies** | **7 HOURS** |
| Introduction to Artificial Intelligence & Machine Learning, Generative AI, Prompt Engineering, Types of Learnings. Basics of Big Data, significance of it. Introduction to Internet of things, IoT overview, Concept of Edge Computing, IOT Edge computing solutions. Need and importance of Cyber Security, Aspects of cyber-Security. | | |
| **PRACTICAL NO.04** | **Overview of Emerging technologies** | **7 HOURS** |
| Digital Technology Domain: Introduction to Block-chain technology, Fundamental concepts of Cloud computing, Concept of Augmented Reality and applications.<br>Industry Automation Domain: Introduction to Robotics and Automation, Robot classification, Robot anatomy, Introduction to Drone, Anatomy of a Customized Drone Technology.<br>Renewable Energy Domain: Solar, Wind, Biofuels, Energy types of fuel cell. Electrical Vehicle (EV), Overview of different systems in EV, Types, Concept of Zero Energy Building (ZEB), Comparison ZEB and Green building, Net zero site energy use, Net zero site source energy use, Net zero energy<br>emissions, Net zero cost Application | | |

| Module 2: WEB TECHNOLOGY MODULE (14 HOURS) [COMPULSORY] | | |
|---|---|---|
| **PRACTICAL NO.01** | **Basic HTML** | **4 HOURS** |
| Web 1.0, , 3.0, 4.0, Basic html tags, formatting tags, color tags, Div and span tags , Ordered list, Unordered list, Image tags, URL tag, table , Form, Hyperlinks. | | |
| **PRACTICAL NO.02** | **Cascading Style Sheets-CSS** | **4 HOURS** |
| Cascading Style Sheets-CSS, Multiple style sheets, Web page Layout and website Designs. | | |
| **PRACTICAL NO.03** | **Digital Portfolio** | **6 HOURS** |
| One-page/multi-page portfolio using HTML, Projection of information, Personal information, Projects, Achievements, Contact details etc. | | |

| Module-3 ADVANCED TECHNOLOGY MODULE (16 HOURS) [CHOICE BASED] | | |
|---|---|---|
| Student will select any one module out of Elevan | | |
| **MODULE NO.3A** | **Artificial Intelligence (AI)** | **16 HOURS** |
| PRACTICAL-1 | Introduction to AI | 02 HOURS |
| PRACTICAL-2 | Image Processing-Object Recognition | 04 HOURS |
| PRACTICAL-3 | Machine Learning- Classification/Prediction | 04 HOURS |
| LAB PROJECT | Lab Project based on AI Application | 06 HOURS |
| **MODULE NO.3B** | **Prompt Engineering for Generative AI** | **16 HOURS** |
| PRACTICAL-1 | Introduction to Generative AI & Prompt Engineering (Basic prompting to Build Generative AI Application) | 02 HOURS |
| PRACTICAL-2 | Designing Prompts for Different Tasks, Prompt Engineering Techniques - N-Shot, Zero Shot and Few Shot Prompting | 04 HOURS |
| PRACTICAL-3 | Content Generation with Prompts (Strategies for generating text, image using prompt) | 04 HOURS |
| LAB PROJECT | Lab Project based on Prompt Engineering for real world prob- lems | 06 HOURS |
| **MODULE NO.3C** | **Block Chain Technology** | **16 HOURS** |
| PRACTICAL-1 | Introduction to Block Chain | 02 HOURS |
| PRACTICAL-2 | Development and Deployment of smart contact | 04 HOURS |
| PRACTICAL-3 | Creation of contact users | 04 HOURS |

| | | |
|---|---|---|
| LAB PROJECT | Lab Project based on Block Chain Technology | 06 HOURS |

| **MODULE NO.3D** | **Cloud Computing** | **16 HOURS** |
|---|---|---|
| PRACTICAL-1 | Creation of AWS account, Service models | 02 HOURS |
| PRACTICAL-2 | Deployment and configuration management | 04 HOURS |
| PRACTICAL-3 | AWS instance on AWS cloud, Deployment of web server | 04 HOURS |
| LAB PROJECT | Lab Project based on Cloud Computing Technology | 06 HOURS |
| **MODULE NO.3E** | **Augmented Reality** | **16 HOURS** |
| PRACTICAL-1 | Introduction to Augmented Reality | 02 HOURS |
| PRACTICAL-2 | Objects, Physics, Light intensity adjustments, Scripts | 04 HOURS |
| PRACTICAL-3 | Development of 3D project and building application | 04 HOURS |
| LAB PROJECT | Lab Project based for Augmented Reality | 06 HOURS |
| **MODULE NO.3F** | **Internet of Things (IOT)** | **16 HOURS** |
| PRACTICAL-1 | Hardware and Software Simulation Environment, Sensor and Actuators | 02 HOURS |
| PRACTICAL-2 | Switch Networking with WiFi module | 04 HOURS |
| PRACTICAL-3 | IoT, Cloud Platforms for IOT | 04 HOURS |
| LAB PROJECT | Lab Project based on IOT | 06 HOURS |
| **MODULE NO.3G** | **Robotics** | **16 HOURS** |
| PRACTICAL-1 | Introduction Components, types components | 02 HOURS |
| PRACTICAL-2 | Sensors, Actuators, Controller and Circuit | 04 HOURS |
| PRACTICAL-3 | Block code | 04 HOURS |
| LAB PROJECT | Lab Project based Robotics | 06 HOURS |

| **MODULE NO.3H** | **Drone Technology** | **16 HOURS** |
|---|---|---|
| PRACTICAL-1 | Battery, Motors, BLDC, Power rating, losses | 02 HOURS |
| PRACTICAL-2 | Flight controllers, Pixhawk, Mamba Controllers | 04 HOURS |
| PRACTICAL-3 | Propellers, Assembly | 04 HOURS |
| PROJECT | Lab Project based on Drone Applications | 06 HOURS |

| MODULE NO.3I | Affordable and Clean Energy | 16 HOURS |
|---|---|---|
| PRACTICAL-1 | Proton Exchange Membrane Fuel cell | 02 HOURS |
| PRACTICAL-2 | Microbial Fuel cell | 04 HOURS |
| PRACTICAL-3 | Open air cathode type fuel cell for car | 04 HOURS |
| LAB PROJECT | Lab Project for Affordable and Clean Energy | 06 HOURS |

| MODULE NO.3J | Electric Vehicles | 16 HOURS |
|---|---|---|
| PRACTICAL-1 | EV Motors and controllers, Battery pack | 02 HOURS |
| PRACTICAL-2 | Assembly and Working of Two-Wheeler EV | 04 HOURS |
| PRACTICAL-3 | Field Visit to Charging Station | 04 HOURS |
| LAB PROJECT | Lab Project for Electric vehicles | 06 HOURS |
| **MODULE NO.3K** | **Zero Energy Building** | **16 HOURS** |
| PRACTICAL-1 | Calculation of Carbon Footprint, Greenness | 02 HOURS |
| PRACTICAL-2 | Calculation of Electricity bill of Family / Hostel/ College Build- ings | 04 HOURS |
| PRACTICAL-3 | Build It Green (PPT/ Video Presentation) | 04 HOURS |
| LAB PROJECT | Model Making | 06 HOURS |
| | | **Continuous** |
| | | (20 Marks) |

**Laboratory Assessment (PR): (40 Marks)**

**Jury (Laboratory Project and Assignment Presentation Exam)**

1. Lab Experiments, Continuous Assessment activities as applicable in respective Modules (10 Marks).
2. Model Making, Poster presentation, Technical Article, Blog, Physical System Development (Ba- sic) etc. activities as applicable in respective Modules (15 Marks).
3. Presentation of Digital portfolio- Presentation of all assignments and activities in the portfolio. (Personal Website). (15 Marks).

**TEXT BOOKS**


1. Solem, J. E. (2012). Programming Computer Vision with Python: Tools and algorithms for analyzing images. ” O’Reilly Media, Inc.”.
2. Vinod Chandra S.S., Hareendran A. S. (2014) Artificial Intelligence and Machine Learning. Pren- tice Hall India Learning Private Limited.
3. Hoff, T. (2017) Explain the cloud like I’m 10: Learn the inner-secrets behind Kindle, Netflix, AWS, Apple, Facebook, and Google. United States: Possibility Outpost Inc.
4. Garren A. (2017). AWS: A Beginner’s Guide to the Basics of Amazon Webservice.
5. Soni, V. (2022). IOT for beginners: Explore IOT architecture, working principles, IOT devices, and various real IOT projects. Inde (BPB Publications).
6. Ford, M. (2016). Rise of the robots: Technology and the threat of a jobless future. Basic Books.
7. Yasodharan R. (2016). Basics of Robotics: To know all about Robotics. (Online).
8. Davies, B. (2016). In Build a drone: A step-by-step guide to designing, constructing, and flying your very own drone. essay, Skyhorse Publishing.
9. Abell, T. (2017). All about drones (Cutting-Edge Technology). North Star Editions.
10. Sandvik, K. B., & amp; Jumbert, M. G. (2016). The good drone (Emerging Technologies, Ethics and International Affairs). Routledge.
11. Liljequist, B., McLennan, F. (2016). The power of Zero: Learning from the world’s leading Net Zero Energy Buildings. Ecotone Publishing.
12. Liu H. (2006). Principles of Fuel Cells. Taylor & Francis.
13. Patel N. (Editor). (2021). Electric Vehicles: Modern Technologies and Trends. Springer.
14. Miles M. (2022). The future in AR (augmented reality) for beginners. Online.

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

# MIT ACADEMY OF ENGINEERING, ALANDI

## Curriculum for Second Year Bachelor of Technology

## Artificial Intelligence

## NEP REVISION 2023 ()

(With Effect from Academic Year: 2025-2026)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| DEPARTMENT OF Artificial Intelligence | W. E. F. | : | 2025-2026 |
| SECOND YEAR BACHELOR OF TECHNOLOGY | RELEASE DATE | : | 01/07/2025 |
| | REVISION NO. | : | (NEP) |

| SEMESTER: III (Artificial Intelligence) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2311211T | Data Structures & Algorithms | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | 2311211L | Data Structures & Algorithm Lab | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| PCC | 2311212T | Artificial Intelligence | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 | |
| PCC | 2311213T | Operating System | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| VSEC | 2311261L | Problem Solving Using OOP(C++) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| | 2311262L | Problem-Solving Using OOP(Java) | | | | | | | | | | | |
| HSSM VEC | 2301287 | Universal Human Values-II | 1 | 4 | - | - | - | 25 | - | 75 | 100 | 3 | |
| OE | 2301257T | Applied Mathematics | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 | |
| | OE List | Open Elective Course | | | | | | | | | | | |
| | 2301257L | Applied Mathematics Lab | | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OE List | Open Elective Course Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| OE | 23BD251L | Prototyping | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 23XX25X | Open Elective | 2 | - | - | 35 | - | 40 | - | - | | |
| ELC PRJ | 2311291L | Project Design | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| **TOTAL** | | | **14** | **20** | **-** | | | | | | **800** | **22** |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| DEPARTMENT OF Artificial Intelligence | W. E. F. | : | 2025-2026 |
| SECOND YEAR BACHELOR OF TECHNOLOGY | RELEASE DATE | : | 01/07/2025 |
| | REVISION NO. | : | (NEP) |

**SEMESTER: IV (Artificial Intelligence)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2311216T | Database Management System | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| | 2311216L | Database Management System Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2311217T | Machine Learning | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | 2311217L | Machine Learning Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| PCC | 2311218T | Computer Network | 3 | - | - | 30 | 20 | 50 | - | - | 100 | 3 |
| VSEC | 2311268L | Object Oriented Programing (Core Java) | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| | 2311269L | Enterprise Application Development (Advanced Java) | | | | | | | | | | |
| MDM | MDM List | MDM Course-I | 2 | - | - | 15 | 20 | 40 | - | - | 75 | 2 |
| | MDM List | MDM Course-I Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| HSSMVEC | 2301286T | Environmental Science | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| HSSMMEC | 2301276 | Entrepreneurship Skills | 1 | 2 | - | - | - | 25 | 20 | 30 | 75 | 2 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ELC PRJ | 2311292L | Project Implementation | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 |
| ELC SI | 2311296L | Internship (Life And Soft Skills) | - | - | - | - | - | - | - | 75 | 75 | 2 |
| Audit | 2301281A | Indian Constitution | 1 | - | - | - | - | - | - | - | Audit | |
| **TOTAL** | | | **14** | **14** | **-** | | | | | | **850** | **22** |

Two Credit Internships need to be completed after Completion of the Second Year.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department Of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY ARTIFICIAL INTELLIGENCE | COURSE NAME | Data Structures and Algorithm |
| | COURSE CODE | 2311211T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE:** Foundations of Computing

**COURSE OBJECTIVES :**

2311211T.CEO.1: To introduce the fundamental concepts of data structures, including their types, operations, and importance in programming..

2311211T.CEO.2: To familiarize students with linked list concepts, including types, operations, and memory management.

2311211T.CEO.3: To describe the principles of Stacks and Queues with real-world examples.

2311211T.CEO.4: To demonstrate various techniques of searching and sorting.

2311211T.CEO.5: To build the ability to identify appropriate data structure for the specified problem.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311211T.CO.1: Perform operations on linear and non-linear data structures [L3]

2311211T.CO.2: Demonstrate the applications of data structures in memory management and data handling [L3]

2311211T.CO.3: Compare different types of data structures based on their properties, advantages, and use cases in problem-solving. [L4]

2311211T.CO.4: Analyse the time and space complexity of various searching, sorting, tree, and graph algorithms. [L4]

**COURSE ABSTRACT:**

The basic aim of the course is to provide the knowledge of organizing and managing the data in the system. The goal is to make students understand the concept of data organization, management, ab- straction, re-usability and efficient processing to retrieve useful information. Fundamentals of primitive data structures, various operations and related algorithms, applicability of data structures in real time applications are all covered in the syllabus.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION TO DATA STRUCTURE** | **08 HOURS** |
| **Applications/Case Study:** Social networking, Recommendation system<br>**Contents:** : Introduction: Data, Information, Data structures, Abstract Data Types (ADT). Classifi- cation of data structures: - linear and Non-linear, Algorithmic complexities: - time and space complexity (iterative and recursive algorithms), Efficiency of algorithms: Big O, theta and omega notations with its significance. Hash Tables: Hashing Techniques and Hash functions.<br>**Self Study:** Arrays in Image Processing<br>**Further Readings:** Arrays in Game Playing, Array and Database. | | |
| **UNIT 2** | **SEARCHING AND SORTING TECHNIQUES** | **07 HOURS** |
| **Contents:** Searching:- Fibonacci Search and Sentinel Search. Sorting: - Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Radix Sort.<br>**Self Study:** Bucket Sort.<br>**Further Readings:** Tim sort. | | |
| **UNIT 3** | **LINKED LIST** | **08 HOURS** |
| **Applications/Case Study:** Google Maps Navigation System<br>**Contents:**Introduction to Linked lists, Linear Data Structure using linked Organization, Comparison of sequential and linked list organizations Linked List as ADT, Types:- Singly linked list, Doubly linked list, Circular linked list. Operations on linked list: insertion, deletion, traversing, searching sorting and reversing, Polynomials Representations:- Addition and Multiplication.<br>**Self Study:** Skip List.<br>**Further Readings:** Web indexing using linked list. | | |
| **UNIT 4** | **STACKS AND QUEUES** | **08 HOURS** |

**Applications/Case Study:** Function Call Management, CPU Scheduling, Syntax checker system for matching braces, Maze solving system.
**Contents:** : Introduction to Stack, implementation of stack using array and Linked List, Applications:

- Expression Evaluation and Conversion. Recursion, Introduction to Queue, Types: - Linear, Circular, Doubly-ended and Priority Queue. Representation and implementation of queue using array and linked list

**Self Study:** Multiple Stacks and multiple Queues
**Further Readings:** Concept of Back Stack, Bandwidth Management and Data Compression using Priority Queue.

| UNIT 5 | TREES | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Social Media Friend Recommendation System.
**Contents:** Introduction to trees, Binary tree and its types, Properties of Binary trees, Binary search tree and operations on BST, Tree traversal techniques: in-order, pre-order, post-order traversal (recur- sive and non-recursive traversal), Introduction to AVL tree and balancing of AVL tree.
**Self Study:** B - Trees
**Further Readings:** Trie (Prefix Tree)

| UNIT 6 | GRAPHS | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Content Ranking (Using PageRank Algorithm)
**Contents:**Terminology and representation of Graphs: adjacency matrix, linked list, DFS and BFS Graphs, minimum Spanning Tree Graph, Dijkstra's-shoertest path.
**Self Study:** Boruvka's MST algorithm
**Further Readings:** Topological Sorting.

**TEXT BOOKS**


G. A. Vijayalakshmi Pai. (2022). *"A Textbook of Data Structures and Algorithms"* , 1st Edition, Wiley-ISTE. ISBN-13: 978-1-394-19206-9.

Paul W. Bible, Lucas Moser. (2023). *"An Open Guide to Data Structures and Algorithms"*, 1st Edition, Ebook ISBN: 978-1-956390-23-0. Print ISBN: 978-1-956390-24-7

Cognella Academic Publishing. (2023). *"Data Structures, Algorithms, and Invariants"*, 1st Edition Cognella Academic Publishing. ISBN-13: 978-1-7935-8884-5.


**E-RESOURCES**

**REFERENCE BOOKS**


https://nptel.ac.in/courses/111105090Programming, Data Structures and Algorithms, IIT Madras (https://nptel.ac.in/courses/106106127)

Richard F. Gilberg, Behrouz A Forouzan. (2016). *"Data structures- A pseudocode Approach with C++"*. 4th Edition, Cengage learning. ISBN 9780534390808.

https://www.youtube.com/@mitocw/courses Data Structures And Algorithms, IIT Delhi (https://nptel.ac.in/courses/106102064)

E. Horowitzs S. Sahani, S. Rajasekharan. (2015). *"Fundamentals of Computer Algorithms"*. Universities Press. ISBN-13: 978-8 173716126

https://www.coursera.org/specializations/data-structures-algorithms Coursera - Data Structures and Algorithms Specialization

Debasis Samanta (2012). *"Classic Data Structures"*. 2nd Edition, Tata McGraw Hill. ISBN-13:

https://leetcode.com/ LeetCode (Best for Competitive Coding Interview Prep)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLEGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY ARTIFICIAL INTELLIGENCE | COURSE NAME | Data Structures and Algorithm Lab |
| | COURSE CODE | 2311211L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**COURSE ABSTRACT:**

The basic aim of the course is to provide the knowledge of organizing and managing the data in the system. The goal is to make students understand the concept of data organization, management, ab- straction, re-usability and efficient processing to retrieve useful information. Fundamentals of primitive data structures, various operations and related algorithms, applicability of data structures in real time applications are all covered in the syllabus.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311211L.CO.1: Compare various data structures (linear and non-linear) based on their properties, advantages, and use cases in solving real-world problems [L4].

2311211L.CO.2: Implement operations on linear and non-linear data structures (such as arrays, linked lists, stacks, queues, trees, and graphs), including insertion, deletion, searching, and traversal [L3].

2311211L.CO.3: Demonstrate the application of data structures in memory management and efficient data handling by building practical solutions [L3].

2311211L.CO.4: Analyze the time and space complexity of common algorithms for searching, sorting, and tree/graph manipulation, and evaluate their suitability for different applications. [L4]

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **ARRAYS** | **4 HOURS** |
| Design and develop a program to perform fundamental operations on an array for a selected application:-<br>**Scope of Assignment :**<br>**T**he program should support the following functionalities:<br>• Insertion: Add a new element to the array.<br>• Updation: Modify an existing element in the array.<br>• Deletion: Remove an element from the array.<br>• Display: Show all elements stored in the array.<br>Self Study: Practice Problem-1 | | |
| **PRACTICAL NO.02** | **HASHING** | **4 HOURS** |
| Implement hashing techniques for efficient data storage and retrieval in real-world applications, using linear probing to resolve collisions in practical scenarios.<br>Self Study: Practice Problem-2 | | |

| PRACTICAL NO.03 | SEARCHING AND SORTING | 12 HOURS |
|---|---|---|
| 1. Develop a program that takes student marks as input and sorts them in ascending order using Selection Sort<br>2. Implement a Merge Sort or Insertion Sort algorithm to sort flight ticket prices in ascending order so that customers can quickly find the lowest fares.<br>3. Develop a sorting system using Quick Sort to sort product ratings in descending order so that highly rated products appear first.<br>4. Develop a Merge Sort or Quick Sort based system to sort job applicants based on experience in descending order so that the most experienced candidates appear first.<br>5. Develop a Sentinel Search algorithm to efficiently search for a product ID in an inventory list. If the product is found, display its details; otherwise, return a ”Product Not Available” message<br>Self Study: Practice Problem - 3 and 4 | | |

| PRACTICAL NO.04 | LINKED LIST | 12 HOURS |
|---|---|---|
| Design and develop a program to implement real-life applications of a Singly Linked List, Doubly Linked List and Circular Linked List by enabling operations such as insertion, updating, searching, sorting, listing, and deletion.<br><br>Self Study: Practice Problem-5 | | |

| PRACTICAL NO.05 | STACK | 8 HOURS |
|---|---|---|
| Given as input a prefix expression. Implement a program for following conversions :-<br>a) Infix to postfix<br>b) postfix evaluation<br>c) Stack using Linked List<br><br>Self Study: Practice Problem-6 | | |

| PRACTICAL NO.06 | CIRCULAR QUEUE | 2 HOURS |
|---|---|---|
| Implement a Circular Queue-based system to manage real-life service requests, ensuring efficient cus- tomer handling using the FIFO approach, where resolved requests free up slots for new entries without data shifting.<br>Self Study: Practice Problem-7 and 8 | | |

| PRACTICAL NO.07 | DOUBLE ENDED QUEUE | 2 HOURS |
|---|---|---|
| Design and implement a program for double ended queue and its operations for a shopping mall under given Scenarios :-<br>a) Input Restricted Deque<br>b) Output Restricted Deque.<br>Self Study: Practice Problem- 9 and 10 | | |
| **PRACTICAL NO.08** | **BINARY SEARCH TREE** | **8 HOURS** |
| A software company is developing a student record management system for a university. The system needs to efficiently store and retrieve student records based on their unique roll numbers using a Binary Search Tree (BST).<br>The university requires the following operations:<br>1. Finding the student with the smallest roll number (minimum key).<br>2. Finding the student with the largest roll number (maximum key).<br>3. Searching for a student using a given roll number.<br>4. Finding the predecessor of a student (the student with the closest smaller roll number).<br>5. Finding the successor of a student (the student with the closest larger roll number).<br>6. Deleting a student's record using their roll number<br>7. BST Display- Inorder, Preorder and Postorder. | | |
| **PRACTICAL NO.09** | **GRAPHS** | **8 HOURS** |
| Design and implement a Graph Traversal System using BFS and DFS to help a delivery company:-<br>1. Find the shortest route to a delivery location using BFS.<br>2. Explore all possible routes for better traffic management using DFS :- | | |

**PRACTICE PROBLEMS**

1. Array Practice Problem for example: Student Mark Analysis System, Movie Ticket Booking System, Inventory Management System
2. Hashing Problem Statements for example:
    - A parking lot assigns parking spots based on vehicle registration numbers. The spot number is calculated using a hash function (e.g., Car Number mod Total Slots). If a collision occurs (spot already taken), it finds the next available slot (Linear Probing) 1. A parking lot assigns parking spots based on vehicle registration numbers. The spot number is calculated using a hash function (e.g., Car Number mod Total Slots). If a collision occurs (spot already taken), it finds the next available slot (Linear Probing)
    - A library system stores books by their ISBN numbers. The hash function maps ISBN mod Table Size to find a book's location. If multiple books hash to the same index (collision), they are stored in the next available slot.
    - A retail store maintains an inventory of products. Each product (identified by a unique code) is stored in a hash table using linear probing to handle collisions. This system quickly updates product details (stock, price) and performs fast lookups during sales or restocking.
3. Implement a program to store names and mobile numbers of your friends in sorted order on names. Search your friend from list using Sentinel search. Insert friend if not present in phone book.
4. Implement a program to store percentage of second year students in array. Write a function for sorting array of floating point numbers in ascending order using Merge Sort.
5. Design linked list for any one of the applications such as:
    - Call Log Management (Singly Linked List)
    - Train Reservation System (Doubly Linked List)
    - Music Playlist Management (Circular Linked List)
6. Implement Stack using two Queues
7. Implement Queue using linked list data Structure
8. Implement Queue using two Stacks
9. Design a task scheduler where tasks can be added at both the front and rear, and high-priority tasks should be processed first.
10. Implement a program to check whether the given string is palindrome or not using doubly ended queue.

**TEXT BOOKS**

G. A. Vijayalakshmi Pai. (2022). *"A Textbook of Data Structures and Algorithms"* , 1st Edition, Wiley-ISTE. ISBN-13: 978-1-394-19206-9.

Paul W. Bible, Lucas Moser. (2023). *"An Open Guide to Data Structures and Algorithms"*, 1st Edition, Ebook ISBN: 978-1-956390-23-0. Print ISBN: 978-1-956390-24-7

Cognella Academic Publishing. (2023). *"Data Structures, Algorithms, and Invariants"*, 1st Edition Cognella Academic Publishing. ISBN-13: 978-1-7935-8884-5.

**REFERENCE BOOKS**

Richard F. Gilberg, Behrouz A Forouzan. (2016). *"Data structures- A pseudocode Approach with C++"*. 4th Edition, Cengage learning. ISBN 9780534390808.

E. Horowitzs S. Sahani, S. Rajashekharan. (2015). *"Fundamentals of Computer Algorithms"*. Universities Press. ISBN-13: 978-8 173716126

Debasis Samanta.(2012). *"Classic Data Structures"*. 2nd Edition, Tata McGraw Hill. ISBN-13:

**E-RESOURCES**

https://nptel.ac.in/courses/111105090 Programming, Data Structures and Algorithms, IIT Madras (https://nptel.ac.in/courses/106106127)

https://www.youtube.com/@mitocw/courses Data Structures And Algorithms, IIT Delhi (https://nptel.ac.in/courses/106102064)

https://www.coursera.org/specializations/data-structures-algorithms Coursera - Data Structures and Algorithms Specialization

https://leetcode.com/ LeetCode (Best for Competitive Coding, Interview Prep)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY ARTIFICIAL INTELLIGENCE | COURSE NAME | ARTIFICIAL INTELLIGENCE |
| | COURSE CODE | 2311212T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE KNOWLEDGE:** Problem-Solving Skills, Discrete Structure, Linear Algebra

**COURSE OBJECTIVES :**

2311212T.CEO.1: To introduce core AI concepts with a focus on ethical decision-making. 2311212T.CEO.2: To develop problem-solving skills through search strategies and intelligent decision-making.

2311212T.CEO.3: To equip students with essential feature engineering techniques to enhance AI model performance, while recognizing ethical use of data and responsible preprocessing.

2311212T.CEO.4: To illustrate diverse applications of soft and evolutionary computing across various domains and real world scenarios.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311212T.CO.1: Apply fundamental AI concepts to solve real-world problems[L3].

2311212T.CO.2: Apply appropriate search strategies to effectively solve AI problem solving scenarios across various domains[L3].

2311212T.CO.3: Utilize feature engineering techniques to enhance model accuracy across data types with ethical data handling [L3].

2311212T.CO.4: Make use of fuzzy logic and evolutionary algorithms for solving real-world problems in optimization and decision-making [L3].

**COURSE ABSTRACT:**

The Artificial Intelligence course provides a comprehensive understanding of the theoretical foundations and practical applications of AI and Machine Learning technologies. It covers key topics such as in- telligent agents, search strategies, knowledge representation, feature engineering, fuzzy logic systems, evolutionary computation, and swarm intelligence.

Students will explore real-world applications, including autonomous systems, GPS navigation, medical diagnosis, and portfolio optimization, preparing them to tackle challenges in optimization, decision- making, and uncertainty management. Self-study topics and further readings foster independent learning and deeper insights into emerging AI trends.

This course emphasizes an implementation-based learning approach, where students will apply theoret- ical concepts through hands-on problem-solving, case studies, and real-world scenarios. The internal assessment and mid-semester evaluation will be designed accordingly to assess both conceptual under- standing and practical application, ensuring that students gain industry-relevant skills.

**THEORY COURSE CONTENTS**

| UNIT 1 | INTRODUCTION TO ARTIFICIAL INTELLIGENCE | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Self-Driving Vehicles and Drones)

**Contents:** Foundation and history of Artificial Intelligence (AI), AI applications and types, Ethical and Social Impacts of AI, Intelligent Agents, Introduction to Reasoning and Knowledge Representation. **Self Study:** Neural Network

**Further Readings:** Artificial General Intelligence.

| UNIT 2 | PROBLEM SOLVING THROUGH SEARCH STRATEGIES | 10 HOURS |
|---|---|---|

**Applications/Case Study:** GPS Navigation System, Chess Game

**Contents:** Search Strategies, State Space Search, Uninformed Search(Breadth-First, Depth-First), Heuristic Search (Greedy Best First Search, A Algorithm, Admissibility of A), Constraint Satisfaction Problem (CSP), Local Search, Minimax Search, Alpha-Beta Pruning, Ethical design of AI systems in decision-making, Transparency in pathfinding and decision logic, Case Studies and Applications: Deep Blue, AlphaZero, Pathfinding in Games, Maze Solving,Network Routing,Puzzle Solving, Game AI,Traveling Salesman Problem.

**Self Study:** Adversarial Search

**Further Readings:** Game Theory

| UNIT 3 | FEATURE ENGINEERING FOR MACHINE LEARNING | 09 HOURS |
|---|---|---|

**Applications/Case Study:** Stock Price Prediction

**Contents:** Introduction to Feature Engineering, Types of Features, Ethical use of features, Re- sponsible data preprocessing, Feature Transformation: Missing Value Imputation, Scaling (Min- Max,Standardization), Encoding (One-Hot, Label), Feature Selection: Chi2 square method, Variance Threshold, Recursive Feature Elimination, Feature Construction: Polynomial Features, Text and Im- age Feature Extraction, Time-Series Feature Engineering, API Integration for Time-Series Data.

**Self Study:** Principal Component Analysis (PCA)

**Further Readings:** Automated Feature Engineering and Ethical Data Practices

| UNIT 4 | SOFT AND EVOLUTIONARY COMPUTING | 05 HOURS |
|---|---|---|

**Applications/Case Study:** Fuzzy Logic in Washing Machines/ Autonomous Vehicles

**Contents:** Introduction to Soft Computing, Fuzzy Logic: Membership Functions, Fuzzy Rules and Reasoning, Applications of Fuzzy Logic, Evolutionary Computation: Swarm Intelligence, Ant Colony Optimization(ACO).

**Self Study:** Particle Swarm Optimization (PSO)

**Further Readings:** Genetic Algorithms and Bio-Inspired Ethical AI

**TEXT BOOKS**


Stuart Russel and Peter Norvig (2022). *Artificial Intelligence: A Modern Approach*. 4th Edition, Pearson. ISBN 978-9356063570.

Rudolf Kruse, Christian Borgelt, Christian Braune, Sanaz Mostaghim, Matthias Steinbrecher (2023). *Computational Intelligence: A Methodological Introduction*. 3rd Edition, Springer. ISBN


**REFERENCE BOOKS**


Dr. Nilakshi Jain (2019). *Artificial Intelligence: Making a System Intelligent*. 1st Edition, Wiley.ISBN 978-8126579945.

Timothy J. Ross (2020). *Fuzzy Sets and Logic with Engineering Applications*. 4th Edition, Wi- ley.ISBN 978-8126502608

Adam Slowik (2022). *Swarm Intelligence Algorithms*. 1st Edition, CRC Press. ISBN 978- 0367496142.

Melanie Mitchell (2020). *Artificial Intelligence: A Guide for Thinking Humans*. 1st Edition, Pelican. ISBN 978-0241404836.

Alice Zheng (2018). *Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists,* . 1st Edition, O'Reilly. ISBN 978-9352137114.

Piyush Deolikar (2025). *Introduction to AdTech: Complete Guide to AdTech,*. 1st Edition,

Amazon LLC. ISBN 979-8893206548

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY ARTIFICIAL INTELLIGENCE | COURSE NAME | OPERATING SYSTEM |
| | COURSE CODE | 2311213T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Programming Knowledge

**COURSE OBJECTIVES :**

2311213T.CEO.1: To impart knowledge of key operating system concepts and its services.

2311213T.CEO.2: To provide comprehensive understanding of the concepts related to process, Inter process communication (IPC), scheduling and deadlock management

2311213T.CEO.3: To discuss memory management schemes in operating system.

2311213T.CEO.4: To develop shell scripting skills to automate routine operating system tasks and system-level operations.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311213T.CO.1: Employ OS concepts of structure, types, and functions to solve basic system-level problems. [L3]

2311213T.CO.2: Apply process management, memory management, and synchronization techniques to solve system-level problems.[L3]

2311213T.CO.3: Implement shell scripting techniques for process automation in operating systems[L3]

2311213T.CO.4: Analyze file systems, I/O management, and scheduling algorithms to improve system efficiency[L4]

2311213T.CO.5: Analyze deadlock conditions and propose strategies for prevention and avoidance in systems.[L4]

**COURSE ABSTRACT:**

This course provides a comprehensive introduction to the design, structure, and functionality of modern operating systems. It covers fundamental concepts such as process management, memory management, file systems, I/O systems, and concurrency control. Students will explore how operating systems serve as an interface between hardware and user-level applications, ensuring efficient resource allocation, system security, and user convenience. Through practical labs and case studies, learners will gain hands-on experience with process scheduling, deadlock handling, virtual memory, and system calls. The course also includes contextual modules that demonstrate OS principles in emerging fields like cloud computing, mobile systems, and AI/ML workload management.

**THEORY COURSE CONTENT**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Operating System** | **5 HOURS** |

**App/System/Case study:** Open Source Operating System-Linx,Role of Ubuntu in TensorFlow- based ML development **Contents:**
Definition, Types, Objectives, and Functions of OS,System Calls, Kernel/User Mode, OS Structures,OS support for AI/ML applications: multitasking, GPU control, and memory management
**Self -Study:** Microkernel vs Monolithic kernel design
**Further Reading:** Use of OS in various computing environments

| | | |
|---|---|---|
| **UNIT 2** | **Process and Thread Management** | **8 HOURS** |

**App/System/Case study:** Programming Language multiprocessing in AI model training **Contents:** Process Lifecycle and Process Control Block, Threads and Multithreading Models, CPU Scheduling: FCFS, SJF, Round Robin, Priority, Context Switching, Process vs Thread in AI execution
**Self-Study:** Multi-threaded vs multi-process architecture in ML pipelines
**Further Reading:** Operating System Debugging

| | | |
|---|---|---|
| **UNIT 3** | **Process Synchronization and Deadlocks** | **8 HOURS** |

**App/System/Case study:** Multithreading in Web Servers
**Contents:** Race Conditions, Critical Section Problem,Synchronization Mechanisms: Semaphores, Mu- texes, Monitors, Deadlock: Detection, Prevention, Avoidance
**Self-study:** Locks and atomic operations in PyTorch/TensorFlow
**Further Reading:** Scheduling Algorithms in RTOS,Python concurrency models

| | | |
|---|---|---|
| **UNIT 4** | **Memory Management** | **8 HOURS** |

**App/System/Case study:** Memory management issues in large model training
**Contents:** Memory Hierarchy, Address Binding,Paging, Segmentation, Virtual Memory,Page Replace- ment Algorithms,OS memory strategies for large ML models
**Self- Study:** System Programming with Linux
**Further Reading:** Use of memory profilers in Python

| | | |
|---|---|---|
| **UNIT 5** | **File and I/O Management** | **8 HOURS** |

**App/System/Case study:** ile I/O bottlenecks in real-time inference systems

**Contents:** File Systems, File Allocation Methods, Directory Structures, File Operations,I/O Buffering, Device Drivers, Disk Scheduling, I/O efficiency in AI data loading pipelines

**Self- Study:** async file operations

**Further Reading:** I/O Optimization.

| UNIT 6 | Linux Essentials and Shell Programming | 8 HOURS |
|---|---|---|

**App/System/Case study:** Bash script to automate model

**Contents:**Linux File System Structure, Users Permissions,Shell Scripting: Variables, Loops, Condi- tions, Functions,Process Automation Cron Jobs,Use of Shell scripts in ML data pre-processing and deployment

**Self- Study:** Writing portable shell scripts using bash, awk, sed

**Further Reading:** GitHub: DevOps scripting repositories

**TEXT BOOKS**


Silberschatz, A., Galvin, P. B., Gagne, G. (2023). Operating System Concepts (10th Edition, International Student Version). Wiley. ISBN: 978-1119800361

Tanenbaum, A. S., Bos, H. (2023).Modern Operating Systems (5th ed.). Pearson Education.ISBN: 978-0137619832

Crowley, C. (1998). Operating systems : a design-oriented approach. Tata Mcgraw-Hill. ISBN : 978-0074635513


**REFERENCE BOOKS**


Stallings, W. (2018). Operating systems : internals and design principles. Pearson. ISBN-13: 9780137516742

Deitel, H. M., Deitel, P. J., and Choffnes, D. R. (2004). Operating Systems. Prentice Hall. ISBN-13:978-0131828278

Bovet, D. P., a Cesati, M. (2021 Reprint).Understanding the Linux Kernel (3rd ed.). O'Reilly Media.ISBN: 978-9352136342

Love, R. (2021).Linux Kernel Development (4th ed.). Addison-Wesley Professional.ISBN: 978-0134167398


**REFERENCE LINKS**

Linux Kernel Documentation (latest) Updated official Linux kernel reference. https://www.kernel.org/doc/html/latest/

MIT Operating Systems Engineering (6.828)-Advanced operating system design resources. https://pdos.csail.mit.edu/6.828/

Operating Systems: Three Easy Pieces – Free PDF, Modern, student-friendly OS textbook with labs and case studies. https://pages.cs.wisc.edu/ remzi/OSTEP/

LinuxCommand.org. Great for beginners learning shell scripting and GNU basics

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F. | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY ARTIFICIAL INTELLIGENCE | COURSE NAME | Problem Solving Using OOP(C++) |
| | COURSE CODE | 2311261L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** BASIC COMPUTING KNOWLEDGE

**COURSE OBJECTIVES :**

2311261L.CEO.1: To demonstrate Object Oriented Programming concepts.
2311261L.CEO.2: To illustrate modularity, scalability and code reusability.
2311261L.CEO.3: To identify various perspectives of a problem.
2311261L.CEO.4: To choose the optimal solution for real life problems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311261L.CO.1: Develop solutions for real world problems using Object Oriented Programming. [L3]
2311261L.CO.2: Choose an appropriate programming solution to reduce complexity. [L3] 2311261L.CO.3: Apply critical thinking and programming skills for problem solving. [L3] 2311261L.CO.4: Utilize logic building traits efficiently for solving real life problems. [L3]

**COURSE ABSTRACT:**

Problem Solving using Object Oriented Programming (C++) is the Skill Development Course. The basic aim of the course is to introduce the students to Object Oriented Programming using C++ and make their concepts clear for designing real time applications using the same. The inclusion of Challenging Problems in the course will enhance students' logical thinking and boost their analytical skills. Various stages in problem solving will help students to deal with complex problems easily. This course will improve students problem solving abilities and coding skills.

**CONTENTS :**

Introduction to C++, Tokens, Data types, Operators, Structure of C++ Programs, Classes and Ob- jects, Constructors, Destructors; Arrays, Expressions and Control Structures, Types of Constructors and Member Functions; Overloading; Reference and Pointers, Dynamic Memory Management; Func- tions in C++: Argument passing in function, Inline Functions, Default Arguments, Constant Argu- ments, Friend class, Friend function; Inheritance; Polymorphism; Exception Handling; std::move in utility; Templates; Standard Template Library; Type casting and cast operators.

**Self Study:** Structures, Union

**Further Readings:** File Handling Operations, Multithreading

| **OBJECT ORIENTED PROGRAMMING:** | | |
|---|---|---|
| **PRACTICAL: All assignments should be performed considering real world applications.** | | |
| **PRACTICAL NO.01** | **CLASS AND OBJECTS** | **2 HOURS** |
| Write a program on class, constructor, destructor, and user-defined functions. | | |
| **PRACTICAL NO.02** | **CONSTRUCTOR TYPES** | **2 HOURS** |
| Implement various types of constructors and member functions. | | |
| **PRACTICAL NO.03** | **OPERATOR OVERLOADING** | **2 HOURS** |
| Write a program on operator overloading using default and parameterized constructors. | | |
| **PRACTICAL NO.04** | **DYNAMIC MEMORY** | **4 HOURS** |
| a) Assignment based on references and pointers.<br>b) Write a program on new and delete operators in C++ for dynamic memory. | | |
| **PRACTICAL NO.05** | **FUNCTION TYPES, FRIEND CLASS** | **4 HOURS** |
| Assignment based on class, objects, this pointer, inline function, static member function and friend class. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.06** | **INHERITANCE** | **2 HOURS** |
| Implement different types of inheritance. | | |
| **PRACTICAL NO.07** | **POLYMORPHISM** | **2 HOURS** |
| Write a program on polymorphism. | | |
| **PRACTICAL NO.08** | **EXCEPTION HANDLING** | **2 HOURS** |
| Implement exception handling operations. | | |
| **PRACTICAL NO.09** | **STD::MOVE IN UTILITY** | **2 HOURS** |
| Write a program on std::move in utility. | | |
| **PRACTICAL NO.10** | **TEMPLATES** | **2 HOURS** |
| Implement class template, function template. | | |
| **PRACTICAL NO.11** | **STANDARD TEMPLATE LIBRARY** | **4 HOURS** |
| a) Assignment based on list class as a container of standard template library.<br>b) Assignment based on vector class as a container of standard template library. | | |
| **PRACTICAL NO.12** | **TYPE CASTING** | **2 HOURS** |
| Assignment based on type casting and casting operators. | | |

| PROBLEM SOLVING: | | |
|---|---|---|
| 01 | BASIC PROGRAMMING | 2 HOURS |
| 02 | NUMBER SYSTEM | 2 HOURS |
| 03 | ARRAY | 2 HOURS |
| 04 | MATRIX | 2 HOURS |
| 05 | STRING | 2 HOURS |
| 06 | MATH | 2 HOURS |
| 07 | BIT MANIPULATION | 2 HOURS |
| 08 | SEARCHING AND SORTING | 2 HOURS |
| 09 | INHERITANCE | 2 HOURS |
| 10 | POLYMORPHISM | 2 HOURS |
| 11 | TEMPLATES/COLLECTION | 2 HOURS |
| 12 | MULTITHREADING | 4 HOURS |
| 13 | STACK AND QUEUE (FURTHER PRACTICE) | 2 HOURS |
| 14 | FILE PROCESSING (FURTHER PRACTICE) | 2 HOURS |

**EXAMINATION SCHEME**

Continuous Assessment: 20 Marks
Mid Semester Practical Examination for Problem Solving: 15 Marks
End Semester Practical Examination for OOP(C++): 20 Marks
End Semester Practical Examination for Problem Solving: 20 Marks

**TEXT BOOKS**

E. Balgurusawmy. (2020). *Object Oriented Programming with C++*. 8th Edition, McGraw Hill Publishers. ISBN 9389949181.

Paul Deitel, Harvey Deitel. (2017). *C++: How to Program*. 10th Edition, Pearson International. ISBN 9789332585737.

Sprankle Maureen. (2011). *Problem Solving and Programming Concepts*. 9th Edition, Person. ISBN 978-0132492645.

Savitch Walter. (2017). *Problem Solving with C++*. 10th Edition, Person. ISBN 978-0134448282.

**REFERENCE BOOKS**

Bjarne Stroustroup. (2014). *Programming - Principles and Practice using C++*. 2nd Edition, Addison-Wesley Educational Publishers Inc . ISBN 978-0275967819.

Herbtz Schildt. (2017). *C++: The Complete reference*. 4th Edition, McGraw Hill Education. ISBN 978-0070532465.

V. Anton Spraul. (2012). *Think Like a Programmer: An Introduction to Creative Problem Solving*. 1st Edition, No Starch Press US. ISBN 978-1593274245.

**E-RESOURCES**

https://nptel.ac.in/courses/106105151
https://nptel.ac.in/courses/106101208

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Problem-Solving Using OOP(Java) |
| | COURSE CODE | 2311262L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** FUNDAMENTALS OF COMPUTING

**COURSE OBJECTIVES :**

2311262L.CEO.1: To demonstrate Object Oriented Programming concepts.
2311262L.CEO.2: To illustrate modularity, scalability and code reusability.
2311262L.CEO.3: To identify various perspectives of a problem.
2311262L.CEO.4: To choose the optimal solution for real life problems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311262L.CO.1: Develop solutions for real-world problems using Object Oriented Programming. [L3]
2311262L.CO.2: Choose an appropriate programming solution to reduce complexity. [L5] 2311262L.CO.3: Apply critical thinking and programming skills for problem solving. [L3] 2311262L.CO.4: Utilize logic building traits efficiently for solving real life problems. [L3]

**COURSE ABSTRACT:**

Problem Solving using Object Oriented Programming (JAVA) is the Skill Development Course. The basic aim of the course is to introduce the students to Object Oriented Programming using JAVA. and make their concepts clear for designing real time applications using the same. The inclusion of Challenging Problems in the course will enhance students' logical thinking and boost their analytical skills. Various stages in problem solving will help students to deal with complex problems easily. This course will improve students problem solving abilities and coding skills.

**CONTENTS :**

Basics of Java, Data Types and Variables, Operators, Control Statements,Looping, Arrays; String, String Buffer, String Builder; Methods, Lambda Expression, Constructor; Object Oriented Program- ming System : Classes and Objects, Modifiers, Inner Classes; Inheritance; Super,This,Static and Final Keywords; Polymorphism: Method Overloading, Method Overriding; Abstraction, Interfaces; Excep- tion Handling, Create Own Exceptions; Multithreading ; Packages, Collections Framework; File Han- dling; Generics; Introduction to Swing: Layout Management , Swing Components ,Text Fields , Text Areas ,Buttons, Check Boxes, Radio Buttons , Lists, Choices, Scrollbars , Windows ,Menus , Dialog Boxes;

**Self Study:** Bytecode in Java ,Bytecode vs Machine code, JRE, Java API,JVM in Java,JVM Archi- tecture, Class Loader,Interpreter in Java Interpreter vs Compiler,Download Install Java Development Kit JDK,Download Eclipse IDE for Java Developers

| **OBJECT ORIENTED PROGRAMMING USING JAVA:** | | |
|---|---|---|
| **PRACTICAL: All assignments should be performed considering real world applications.** | | |
| **PRACTICAL NO.01** | **FUNDAMENTALS OF JAVA** | **4 HOURS** |
| a) Write a program based on the basics of Java<br>b) Implement a program using Control Statement, Looping, Array | | |
| **PRACTICAL NO.02** | **STRING, STRING BUFFER, STRING BUILDER** | **2 HOURS** |
| a) Program for implementing string operations | | |
| **PRACTICAL NO.03** | **CLASS-OBJECT, METHODS, CONSTRUCTORS AND LAMBDA EXPRESSION** | **4 HOURS** |
| a) Write a program to create Class, declare Member Variables, Define Methods<br>b) Program to define Constructor, Passing Information to a Method or a Constructor.<br>c) Program to define lambda expression | | |
| **PRACTICAL NO.04** | **JAVA INHERITANCE** | **2 HOURS** |

| |
|---|
| a) Program to implement all types of Inheritance |

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **STATIC, FINAL , SUPER AND THIS KEYWORD** | **2 HOURS** |
| a) Program to implement static, final , super and this keyword in java | | |
| **PRACTICAL NO.06** | **POLYMORPHISM** | **2 HOURS** |
| a) Program to implement polymorphism | | |
| **PRACTICAL NO.07** | **JAVA ABSTRACT CLASS AND INTERFACES** | **2 HOURS** |
| a) Write a program based on Abstract Class<br>b) Write a program based on Interfaces | | |
| **PRACTICAL NO.08** | **EXCEPTION HANDLING** | **2 HOURS** |
| a) Implement a program to handle different exceptions<br>b) Implement a program to create own exception class | | |
| **PRACTICAL NO.09** | **JAVA SWING** | **4 HOURS** |
| a) Write a program for multi threading<br>b) Write a program to create Frame and make use of Layout Management, User Interface Components | | |
| **PRACTICAL NO.10** | **PACKAGES AND COLLECTIONS** | **2 HOURS** |
| a) Implement a program to create own package<br>b) Implement a program based on Java collections | | |
| **PRACTICAL NO.11** | **FILE HANDLING** | **2 HOURS** |
| a) Write a program for file handling operations | | |
| **PRACTICAL NO.12** | **JAVA GENERICS** | **2 HOURS** |
| a) Implement various generic functions and generic class | | |

| PROBLEM SOLVING USING JAVA: | | |
|---|---|---|
| 01 | BASIC PROGRAMMING | 2 HOURS |
| 02 | NUMBER SYSTEM | 2 HOURS |
| 03 | ARRAY | 2 HOURS |
| 04 | MATRIX | 2 HOURS |
| 05 | STRING | 2 HOURS |
| 06 | MATH | 2 HOURS |
| 07 | BIT MANIPULATION | 2 HOURS |
| 08 | SEARCHING AND SORTING | 2 HOURS |
| 09 | INHERITANCE | 2 HOURS |
| 10 | POLYMORPHISM | 2 HOURS |
| 11 | COLLECTION | 2 HOURS |
| 12 | MULTITHREADING | 4 HOURS |
| 13 | STACK AND QUEUE (FURTHER PRACTICE) | 2 HOURS |
| 14 | FILE PROCESSING (FURTHER PRACTICE) | 2 HOURS |

| MIT Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | UNIVERSAL HUMAN VALUES-II |
| | COURSE CODE | 2301287 |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | NEP |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | 4 | NIL | NIL | 25 | NIL | 75 | 100 |

**COURSE OBJECTIVES :**

2301287.CEO.1: To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

2301287.CEO.2: To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct under- standing of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

2301287.CEO.3: To highlight plausible implications of such a Holistic understanding in terms of eth- ical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

2301287.CEO.4: To enhance students confidence by strengthening their Professional Skills and Leader- ship quality. Thus, this course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

2301287.CEO.5: To develop essential soft skills such as leadership, creative writing, and effective com- munication through practical activities that encourage collaboration and selfaware- ness.

2301287.CEO.6: To enhance critical thinking and ethical decision-making skills via scenario-based role plays and group discussions, preparing students for real-world challenges.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301287.CO.1: Evaluate the significance of value inputs in formal education and start applying them in their life and profession [L4].

2301287.CO.2: Analyze the value of harmonious relationship based on trust and respect in their life and profession [L3].

2301287.CO.3: Examine the role of a human being in ensuring harmony in society and nature [L3].

2301287.CO.4: Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession [L4].

2301287.CO.5: Demonstrate improved leadership and communication skills by effectively collaborating and articulating ideas in team settings [L3].

2301287.CO.6: Apply critical thinking and ethical considerations in decision-making, showcasing en- hanced time management and problem-

**COURSE ABSTRACT**

Every human being has two sets of questions to answer for his/her life: a) what to do? and b) how to do? The first set pertains to the value domain, and the other to the skill domain. Both are complimentary, but value domain has a higher priority. Today, education has become more and more skill biased, and hence, the basic aspiration of a human being, that is to live with happiness and prosperity, gets defeated, in spite of abundant technological progress. This course helps students develop the right understanding and feelings for ethical living. It covers self-exploration, distinguishing between self and Body, building healthy relationships, understanding societal goals, and promoting mutual fulfilment with nature. These insights prepare students to lead ethical lives and professions. Basically, lab is a class that puts together theory and practice on some important soft skills in a dynamic environment. Students shall develop leadership, critical thinking, time management, presentation skills, decisionmaking, emotional intelligence, among others, through very interactive sessions and exercises. This lab will help students succeed in their profession with ethical conduct and collaboration.

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **Introduction-Basic Human Aspiration, its fulfillment through All-encompassing Resolution** | **3 HOURS** |

| |
|---|
| **Contents:** The basic human aspirations and their fulfillment through Right understanding and Res- olution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.<br>**Self Study:** Exploration of self aspirations and their fulfillment. |

| | | |
|---|---|---|
| **UNIT 2** | **Right Understanding (Knowing) - Knower, Known & the Process** | **3 HOURS** |
| **Contents:** The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence its inter- connectedness and co-existence; and finally understanding the role of human being in existence (human conduct).<br>**Self Study:** SWOC Analysis. | | |
| **UNIT 3** | **Understanding Human Being** | **3 HOURS** |
| **Contents:** Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self<br>**Self Study:**Exploration of the relationship between self and other. | | |
| **UNIT 4** | **Understanding Nature and Existence** | **3 HOURS** |
| **Contents:** A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self-awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Partic- ipation of Human in this harmony/ order leading to comprehensive knowledge about the existence). **Self Study:** Exploration of the relationship between self and Nature. | | |
| **UNIT 5** | **Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living** | **3 HOURS** |
| **Contents:** Understanding Human Conduct, different aspects of All-encompassing Resolution (un- derstanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence.<br>**Self Study:** Exploration of the relationship between self and Universe. | | |

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| **PRACTICALS**: PART A (30 Marks) |

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Skill development: Leadership Skills** | **4 HOURS** |
| Activities: Group Discussion- 1. Self and Resolution 2. Values and Skills. | | |
| **PRACTICAL NO.02** | **Skill development: Creative Writing Skill** | **4 HOURS** |
| Activities: SWOC analysis, Creative Writing: Assignment (Blog, Essay, Articles etc.). | | |
| **PRACTICAL NO.03** | **Skill development: Time Management** | **4 HOURS** |
| Activities: Debate, Social Project with time management. | | |
| **PRACTICAL NO.04** | **Skill development: Presentation Skills** | **4 HOURS** |
| Activities: Presentation, Picture Description. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **Skill development: Decision Making, Interpersonal Communication, Emotional intelligence** | **4 HOURS** |
| Activities: Scenario based Decision Making, Role Play- Voice Modulation. | | |
| **PRACTICALS**: PART B (20 Marks) | | |
| **PRACTICAL NO.06** | **Verbal, Reasoning and Aptitude Training** | **24 HOURS** |
| • Articles, Tenses, Close Passages<br>• Vocabulary Test, Verb Agreement, Active/Passive Voice<br>• Antonyms, Synonyms, Preposition<br>• Idioms and Phrases, Jumbled Sentences, Reading Comprehension<br>• Sentence Completion, Sentence Correction, Spotting Error<br>• Confusing Words, One Word Substitution, Fill in the blanks<br>• Parts of Speech, Reported Speech, Change of Speech | | |
| **PRACTICALS**: PART C (24 Marks) | | |
| **PRACTICAL NO.07** | **Final Assessment with Help of Career Assessment Tests** | **15 HOURS** |
| Employability and Aptitude assessment tool. | | |

**TEXT BOOKS**


Gaur, R. R., Sangal, R., & Bagaria, G. P. (2010). A Foundation Course in Human Values and Professionals Ethics. Excel Books India.

Premvir Kapoor (2022), Professional Ethics and Human Values, Khanna Book Publishing, New Delhi.

Tracy, B. (2008). Speak to Win: how to present with power in any situation. Amacom.

**REFERENCE BOOKS/LINKS**


- A N Tripathy, (2003), Human Values, New Age International Publishers.
- Meadows, D. H., Meadows, D. H., Randers, J., & Behrens III, W. W. (1972). The limits to growth: a report to the club of Rome (1972). Google Scholar, 91, 2.
- A Nagraj, (1998), Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
- Monk, S. (2016). Programming Arduino: getting started with sketches. McGraw-Hill Education.
- P L Dhar, RR Gaur, (1990), Science and Humanism, Commonwealth Publishers.
- Subhas Palekar, (2000), How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
- E G Seebauer& Robert L. Berry, (2000), Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
- M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human
- B P Banerjee, (2005), Foundations of Ethics and Management, Excel Books.
- B L Bajpai, ()2004), Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
- https://www.youtube.com/watch?v=hZSARM4VaVs
- https://www.youtube.com/watch?v=9-T_zwmnZSc

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY ARTIFICIAL INTELLIGENCE | COURSE NAME | APPLIED MATHEMATICS |
| | COURSE CODE | 2301257T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | TUTO-RIAL/PRACTICAL | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE:** NIL

**COURSE OBJECTIVES :**

2301257T.CEO.1: To evaluate matrix properties and solve linear systems using vector space concepts.
2301257T.CEO.2: To apply probability distributions and hypothesis testing for statistical problem solving.
2301257T.CEO.3: To apply Markov analysis to model real world stochastic systems. 2301257T.CEO.4: To solve theoretically the problems of regression and numerical method and calculus applications.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2301257T.CO. 1: Compute the eigen values and eigen vectors of a matrix, apply vector operations. [L3]
2301257T.CO. 2: Analyze real world problems using probability distribution and hypothesis testing. [L4]
2301257T.CO. 3: Model sequential data using Markov chains. [L3]
2301257T.CO. 4: Solve regression,numerical method and calculus applications. [L3]

**COURSE ABSTRACT:**

This course is designed to build a strong mathematical foundation for students pursuing engineering. It introduces essential topics such as Linear Algebra, Probability and Statistics, Hypothesis Testing, Stochastic Processes, Regression Analysis, and Numerical Methods. Students will learn to model, ana- lyze, and interpret data-driven problems through theoretical and applied mathematical techniques. The course emphasizes structured problem-solving, logical reasoning, and critical thinking, helping students to build a solid conceptual understanding applicable across multiple engineering domains. By mastering these mathematical tools, learners will be better equipped to analyze data, identify patterns, and solve complex real-world problems with precision and clarity.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **LINEAR ALGEBRA** | **12 HOURS** |
| **Application/Case Study: Text Data Representation using Vectors (Bag of Words Model)**<br>**Contents:** Basic Concepts, Matrix Addition, Scalar Multiplication, Matrix Multiplication, Linear Sys- tems of Equations, Rank of a Matrix, Eigenvalues, Eigenvectors, Symmetric Matrices, Skew-Symmetric Matrices, Orthogonal Matrices. Similarity of Matrices, Diagonalization, Vector Spaces, Basis, Di- mension of vector spaces, Linear Independence, Inner Product Spaces. Vector Operations: Addi- tion/subtraction, scalar multiplication, Dot product (projections, similarity), Cross product (3D appli- cations), Vector Calculus: partial and first-order derivatives of vectors.<br>**Self Study:** Gaussian elimination, row-echelon form<br>**Further Readings:** Matrix Decompositions | | |
| **UNIT 2** | **PROBABILITY DISTRIBUTION** | **08 HOURS** |
| **Application/Case Study: Covid data ananlysis**<br>**Contents:** Fundamentals of Probability, Random variables and their distributions: Random variables (discrete and continuous), Probability functions, Density and distribution functions, Mean and variance, two dimensional random variables joint probability mass functions, conditioning and independence, Bayes' Theorem, Maximum Likelihood Estimation. Fundamental Sampling Distributions: Random Sampling, Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem, Sampling Distribution of S2, t–Distribution, F- Distribution.<br>**Self Study:** Chi-Square Distribution<br>**Further Readings:** Multivariate Central Limit Theorem. | | |
| **UNIT 3** | **HYPOTHESIS TESTING** | **07 HOURS** |

**Application/Case Study: Pharmaceutical Drug Trial**

**Contents:** Parameter and statistic, Concept of null and alternative hypotheses, Acceptance and critical regions, Probabilities of Type I and Type II errors, Level and Power of a test. Concept of p-value, Large sample tests (tests for single mean, difference of means, single proportion, difference of proportions), Tests for small samples (t-test for single mean and difference of means, test for comparison of variances) **Self Study:** Multinomial probability distribution

**Further Readings:** Factors Affecting power of a Test

| UNIT 4 | STOCHASTIC PROCESSES AND MARKOV CHAINS | 05 HOURS |
|---|---|---|

**Application/Case Study: Weather Forecasting**

**Contents:** Introduction to Stochastic processes- Markov process. Transition Probability, Transition Probability Matrix, First order and Higher order Markov process, nstep transition probabilities, Markov chain, Steady state condition, Markov analysis.

**Self Study:** Irreducible Markov chain

**Further Readings:** Steady-State (Stationary) Distributions in Markov Chains

| UNIT 5 | CORRELATION AND REGRESSION ANALYSIS | 06 HOURS |
|---|---|---|

**Application/Case Study: Analyzing the Relationship Between Height and Weight of Students**

**Contents:** Introduction, Types of Correlation, Karl Pearson Coefficient Correlation, Spearman's Rank Order Correlation, Partial Correlation, Residuals and Plots, Simple Linear Regression, Multiple Re- gression Model, Least Squares and the Fitted Model, Properties of the Least Squares Estimators, Inferences Concerning the Regression Coefficients, Prediction, Simple Linear Regression Case Study Time-dependent regression: Introduction of Time series Analysis, ARIMA, and SARIMA techniques. **Self Study:** Partial Correlation

**Further Readings:** Probability interpretation of regression and correlation

| UNIT 6 | NUMERICAL METHODS and CALCULUS APPLICATIONS | 07 HOURS |
|---|---|---|

**Application/Case Study: Temperature Prediction using Interpolation and Numerical Differentiation**

**Contents:** Numerical Differentiation and Integration, Interpolation: Finite Differences, Newton's and Lagrange's Interpolation. Numerical solution of System of linear equations by Gauss elimination method, LU- Decomposition method.Taylor series, maxima and minima, optimization involving a single variable.

**Self Study:** Spline Interpolation.

**Further Readings:** Cubic Splines

**TEXT BOOKS**

Erwin Kreyszig, (2015), Advanced Engineering Mathematics, 10 th edition, Wiley Eastern Ltd.

Dr. B.V. Ramana, (2017), Higher Engineering Mathematics, 5 th edition, Tata McGraw Hill.

Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability Statistics for Engineers and Scientists, 9th Ed. Pearson Publishers

**REFERENCE BOOKS**

S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications

B.S. Grewal, (2018), Higher Engineering Mathematics, 44 th edition, Khanna Publications.

T.T. Soong, Fundamentals of Probability And Statistics For Engineers, John Wiley Sons Ltd, 2004.

Sheldon M Ross, Probability and statistics for Engineers and scientists, Academic Press.

**E-RESOURCES**

Linear Algebra By Prof. Dilip P. Patil — IISc Bangalore

Introduction to Abstract and Linear Algebra By Prof. Sourav Mukhopadhyay — IIT Kharagpur

Numerical Methods for Engineers By Prof. Niket Kaisare — IIT Madras

Numerical Methods By Mansoor P — MES College of Engineering Kuttippuram, Kerala

Probability and Statistics by By Prof. Somesh Kumar, IIT Kharagpur

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY ARTIFICIAL INTELLIGENCE | COURSE NAME | APPLIED MATHEMATICS LAB |
| | COURSE CODE | 2301257L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**COURSE OBJECTIVES :**

2301257L.CEO.1: To develop a strong foundation in linear algebra, probability, and statistical methods essential for solving real-world problems in engineering.

2301257L.CEO.2: To enable students to apply concepts of hypothesis testing, correlation, regression, and stochastic processes for data-driven decision-making and prediction.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2301257L.CO.1: Apply fundamental concepts of linear algebra and probability and statistical methods to solve engineering and scientific problems [L3]

2301257L.CO.2: Analyze datasets using statistical and numerical methods to derive meaningful inter- pretations and insights. [L4]

2301257L.CO.3: Analyze mathematical models and computational solutions using algorithmic tech- niques to support prediction,

**COURSE ABSTRACT:**

This lab course provides hands-on experience in computational techniques essential for solving problems in linear algebra, probability, statistics, and numerical methods. Students will implement algorithms to solve the mathematical problems. The course emphasizes the use of Python programming for nu- merical computation and data analysis. Through practical exercises, students will strengthen their understanding of mathematical concepts and enhance their problem-solving and coding skills.

| **PRACTICALS : :Perform following experiments using python programming language** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Linear Algebra** | **4 HOURS** |
| 1. Perform matrix addition, multiplication, and scalar operations.<br>2. Compute eigenvalues/eigenvectors and diagonalize a matrix.<br>3. Implement Gaussian elimination from scratch. | | |
| **PRACTICAL NO.02** | **Probability Distributions** | **6 HOURS** |
| 1. Demonstrate Discrete and Continuous Random Variables (Binomial and Normal Distributions)<br>2. Implement Joint Probability Mass Function<br>3. Implement central limit theorem and plot probability distribution<br>4. Generate t & f distribution | | |
| **PRACTICAL NO.03** | **Hypothesis Testing** | **4 HOURS** |
| 1. Perform Large Sample Test for Single Mean (Z-test)<br>2. Perform Small Sample t-test for Difference of Means<br>3. Perform Test for Single Proportion (Large Sample)<br>4. Perform F-test for Comparison of Variances (Small Samples) | | |
| **PRACTICAL NO.04** | **STOCHASTIC PROCESSES & MARKOV CHAINS** | **4 HOURS** |
| 1. Perform First-Order Markov Process Simulation<br>2. Calculate n-Step Transition Probability.<br>3. Calculate Steady State Distribution<br>4. Simulate Higher-Order Markov Process (Second-Order) | | |
| **PRACTICAL NO.05** | **CORRELATION AND REGRESSION ANALYSIS** | **6 HOURS** |
| 1. Calculate Karl Pearson's Coefficient of Correlation<br>2. Calculate Spearman's Rank Order Correlation<br>3. Use any dataset and solve Simple Linear Regression<br>4. Use any dataset and solve Multiple Linear Regression | | |
| **PRACTICAL NO.06** | **NUMERICAL METHODS** | **6 HOURS** |
| 1. Implement Lagrange's Interpolation method<br>2. implement Newton's Interpolation method<br>3. Apply Gauss Elimination for Linear Systems<br>4. Apply LU Decomposition for Linear Systems | | |

**TEXT BOOKS**

”Python for Data Analysis” – Wes McKinney (O’Reilly Media, 2nd Edition)

”A Primer on Scientific Programming with Python” – Hans Petter Langtangen (Springer, 5th Edition)

**REFERENCE BOOKS**

”Numerical Python: Scientific Computing and Data Science Applications” – Robert Johansson (Apress, 2nd Edition)

Trevor Hastie,Robert Tibshirani, Jerome Friedman. The Elements of Statistical Learning:

”Think Stats: Exploratory Data Analysis in Python” – Allen B. Downey (O’Reilly Media, 2nd Edition)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF DESIGN | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Prototyping |
| | COURSE CODE | 23BD251L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | NEP |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**COURSE OBJECTIVES :**

23BD251L.CEO.1: To disseminate different types of prototyping tools and techniques. 23BD251L.CEO.2: To impart the product development cycle through prototype projects. 23BD251L.CEO.3: To inculcate hands-on skills for the development of prototyping as a team. 23BD251L.CEO.4: To develop the ability to transmit multi-prototype information clearly and test the same by demonstration and presentation

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

23BD251L.CO.1: Identify the techniques, skills and modern engineering tools [L3]
23BD251L.CO.2: Apply multi-skills to build/develop/prepare a prototypes [L3]

23BD251L.CO.3: Analyze prototypes developed with tools and machines [L4]

23BD251L.CO.4: Evaluate the prototypes work carried out in a team [L5]

**PRACTICAL**

**Course Introduction:**

This course aims to work on a product/prototype development process based on multi-disciplinary aspects such as Mechanical, Civil, Computer, and Chemical modules. The main objective of this course is to learn different types of prototyping techniques, product development processes, etc. Students will learn to design, build and debug different engineering interdisciplinary products as a prototypes in team. Students will complete four modules in a rotational manner. Following is a brief introduction of individual modules such as,

1. Mechanical Prototyping (MP): Students will learn the different principles of Rapid Prototyping Techniques(RPT), model slicing, and 3D printing processes to manufacture a prototype through hands- on experience.

2. Civil Prototyping (CP): Students will learn basic skills of civil engineering and its product design. They perform tasks using concepts of Bamboo Architecture Design, and bamboo joinery by scaling down the structure prototype from selected materials.

3. Software Prototyping (SP): Students will get exposure to the software development life cycle (SDLC), and the use of the AEIOU Framework (Design Thinking) to decide the problem statement and its solution.

4. Chemical Prototyping (CHP): Students will learn and develop different chemical products in the form of chemical prototypes. They will prepare basic products such as sanitizer, bio-diesel, sanitizer, pen ink, soap, etc.

| **MODULE: 1/4** | **Mechanical Prototyping (MP)** | **16 HOURS** |
|---|---|---|

**PRACTICAL:**

| **PRACTICAL NO. 01** | **Introduction to Prototyping** | **02 HOURS** |
|---|---|---|

1. Introduction to prototyping, types of various prototypes, traditional prototyping vs. advanced rapid Prototyping. Types of rapid prototyping techniques.
2. Demand, applications, and growth of 3D printing in product development.
3. Case studies and need of prototypes in emerging fields like Bio - medicals, defense, manufacturing, aerospace, automobile industry, food industry, aviation,etc.

| **PRACTICAL NO. 2** | **Basics of CAD Modeling** | **02 HOURS** |
|---|---|---|

1. Introduction of 2D, 3D modelling using CAD software package.
2. Sketcher-workbench and its applications.
3. Part design workbench with generative sketching. Identify physical constraints of prototyping.

| PRACTICAL NO. 3 | 3D Modeling for Prototyping | 04 HOURS |
|---|---|---|

1. Introduction of 3D modeling and its interaction with prototype machines
2. Geometric modeling, types of geometric models, and solid models.
3. Case study on design based models.

| PRACTICAL NO. 04 | Pre-processing of 3D Model Slicing | 02 HOURS |
|---|---|---|

1. Pre-Processing the 3D Model in Cura software / 3D Slicer/ Eiger for slicing.
2. Selection of orientation of model, support generation, skin and wall thickness, speed and time for slicing and printing.

| PRACTICAL NO. 05 | Demonstration and 3D Printing | 04 HOURS |
|---|---|---|

1. Suitable filament material for 3D printing and selection for additive manufacturing types.
2. Demonstration of 3D printing machines, their pre-setting and filament material loading process.
3. Self-study of Bill of material (BOM).

| PRACTICAL NO. 06 | Project Presentation and Evaluation | 02 HOURS |
|---|---|---|

1. Final Presentation and demonstration of models
2. Demonstration in the video form and upload on YouTube as a digital portfolio.

| MODULE: 2/4 | Civil Prototyping (CP) | 16 HOURS |
|---|---|---|
| **PRACTICAL:** | | |
| **PRACTICAL NO. 01** | **Introduction to Sustainable Materials** | **04 HOURS** |
| Introduction of Prototyping. Uses of sustainable material and its properties. Sustainable Materials- Bamboo, Timber, Recycled material, etc. 3D models and animation of products. Case studies on bamboo structures. | | |
| **PRACTICAL NO. 02** | **Design of Bamboo Joinery** | **04 HOURS** |
| Hands-on practice on different types of joinery. Fish mouth joints, lash joints, lapping joints, etc. Develop new designs of joints. | | |
| **PRACTICAL NO. 03** | **Making of Structures/Product** | **04 HOURS** |
| Making of scaled/scale-down structures/products from the selected material. Products like chairs, stools, tensegrity structure, slit techniques, road barriers, etc. | | |
| **PRACTICAL NO. 04** | **Cost Analysis for the Structure/Product** | **02 HOURS** |
| Detailed cost estimation/analysis of the structure/product. | | |
| **PRACTICAL NO. 05** | **Final Video Presentation (Evaluation)** | **02 HOURS** |
| Final Presentation and demonstration of models. Demonstration in the video form and upload on YouTube as a digital portfolio. | | |

**REFERENCE BOOK**


Beer & Johnston (2018), Vector Mechanics for Engineers: statics and dynamics, 10th edition, McGraw Hill Education, ISBN: 978-0073398242.

Chris van Uffelen (2013), Bamboo Architecture & Design (Architecture & Materials), by ISBN: 978-3037681824.

Jules J.A. (2015), Designing and Building with Bamboo, Janssen Technical University of Eindhoven Eindhoven, The Netherlands, ISBN 978-8186247464.

| MODULE: 3/4 | Software Prototyping (SP) | 14 HOURS |
|---|---|---|
| **PRACTICAL:** | | |
| **PRACTICAL NO. 01** | **Introduction to Software Engineering** | **02 HOURS** |
| Concepts, Software development life cycle (SDLC). Students need to use AEIOU Framework (Design Thinking) to decide the problem statement. Students will work in groups of three on the AEIOU framework | | |
| **PRACTICAL NO. 02** | **Requirement Analysis** | **02 HOURS** |
| Find the requirement specification of a given problem statement and formulate the feasible solution. | | |
| **PRACTICAL NO. 03** | **Design UML Diagrams for given Problem Statement** | **02 HOURS** |
| Project Development Canvas and then design the following, using a lucid chart tool. Creation of use case diagram, design of an activity diagram, design of Sequence diagram. | | |
| **PRACTICAL NO. 04** | **Design Analysis** | **02 HOURS** |
| Create High Fidelity Prototype using proto.io | | |
| **PRACTICAL NO. 05** | **Prototype Implementation** | **04 HOURS** |
| Web site development using tools such as HTML, JSCRIPT, Proto.io, Invision etc. | | |
| **PRACTICAL NO. 06** | **Presentation** | **02 HOURS** |
| Each group will be given 10 min to present their work | | |

**REFERENCE BOOK**


Roger S, Pressman (2016), Software Engineering A practitioner's Approach, 7th Edition, ISBN: 9780073375977.

Jonathan Arnowitz, MichaleArent (2014), Effective prototyping for software Makers, ACM Digital Library, ISBN-13:978-0120885688

Chua, C. K., Leong, K. F. (2010), Rapid Prototyping: Principles and applications in manufac- turing, New York: Wiley, ISBN: 978-9812778987.

Fab - Gershenfeld, N. (2018), The coming revolution on your desktop - from personal computer to personal fabrication, New York: Basic Books. ISBN:978-0465027453.

Noorani, R. (2016), Rapid prototyping: Principles and applications, NJ: Wiley.ISBN: 978-0-471- 73001-9.

Pham D. T.,Dimov S. S. (2011), Rapid manufacturing: The technologies and applications

| MODULE: 4/4 | Chemical Prototyping | 14 HOURS |
|---|---|---|
| **PRACTICAL:** | | |
| **PRACTICAL NO. 01** | **Introduction to manufacturing process** | **02 HOURS** |
| Introduction to chemical prototype and manufacturing process. Selection of manufacturing product and method. | | |
| **PRACTICAL NO. 02** | **Basic material selection** | **04 HOURS** |
| Introduction of the method and material selection. Block diagram for the process. | | |
| **PRACTICAL NO. 03** | **Manufacturing of the Product** | **06 HOURS** |
| Used unit operation and raw material for manufacturing and performance of actual experimentation | | |
| **PRACTICAL NO. 04** | **Project presentation** | **02 HOURS** |

1. Final Presentation and demonstration of models.
2. Report submission (Final Assessment and Evaluation).

**Evaluation Structure:**

| **Prototyping Module** | | **Group Size** | **Demo / Presentation** (40 Marks) | | | **Continuous Activities** (35 Marks) | | **Total Marks** (75 Marks) |
|---|---|---|---|---|---|---|---|---|
| No. | Name | Student | Submission Mode | Report | PPT/ Video | Activity | Quiz | Total Ac - tivity |
| 1 | Mechanical | 5 | Report & Video/PPT | Yes | Yes | 02 | 01 | 05 |
| 2 | Civil | 5 | Report & Video | Yes | Yes | 02 | 01 | 05 |
| 3 | Computer | 5 | Presentation | Yes | Yes | 03 | 00 | 05 |
| 4 | Chemical | 5 | Report & Video/PPT | Yes | Yes | 02 | 01 | 05 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: (Rev.2023(NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY ARTIFICIAL INTELLIGENCE | COURSE NAME | Project Design |
| | COURSE CODE | 2311291L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**COURSE OBJECTIVES :**

2311291L.CEO.1: To develop a sense of curiosity and critical thinking approach for designing solutions to the real world problems.

2311291L.CEO.2: To disseminate the project planning-scheduling techniques and industry standards.

2311291L.CEO.3: To comprehend ethical principles, code of conduct, safety standards in general and its importance in project documenting and ethical writing.

**COURSE OUTCOMES :**

After completion of the course, the student will be able to,

2311291L.CO.1: Design solutions for solving real world problems using critical thinking systematic approach [L3].

2311291L.CO.2: Plan the project activities with respect to timeline, skills and resources required con- sidering the project costs estimations [L3].

2311291L.CO.3: Apply the knowledge of professional ethics and Industry standards for project design and documentation [L3].

2311291L.CO.4: Demonstrate an ability to integrate the multiple project design ideas to develop the designs of product/ processes/ software [L4].

**COURSE ABSTRACT**

It is a need of the time to pay attention to the societal needs by an engineering graduate to solve some of the real life societal problems by providing affordable technological solutions. The concept of the field project follows the same theme. The project design aims to identify the problems that are faced by the society and develop the systems / processes / products to provide solutions for the same using science and technology for the betterment of society or human life. This may help students to understand the process of product/project development, best practices and encourage their creativity to solve real life problems. The students shall refer scientific literatures from the books, journals of repute. The students shall learn effective team building, designing, budgeting, planning, engineering skills and processes, safety norms and industry standards while developing the application/ products / processes. The students shall learn the importance of technical documentation and professional ethics.

**Guidelines**

Every student shall undertake the Project in semester III and IV.

Every student shall work on an approved project, preferably a field project to work in a group of 03/04 (Max.) students.

The group members may be from different programme to support the interdisciplinary / multi- disciplinary functioning.

The students have to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.

Collect the sufficient data and survey to establish the criticality of the problem to be solved.

Apply various tools for project planning and design.

Critically analyze various design solutions/techniques to solve real world problems.

Select and justify one of the solutions identified based on the feasibility, affordability and ease of use.

Learn and apply industry standards and professional ethics.

**TIMELINE**

The THREE member jury/committee will be appointed to monitor the progress and continuous eval- uation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

Formation of Project Group and topic exploration: 2 Weeks ($1^{st}$ and $2^{nd}$ week)

Finalizing title, survey, feasibility study and approval: 3 Weeks ($3^{rd}$ to $5^{th}$ week)

Engineering Ethics: $3^{rd}$ week

Project Review 1 Presentation: $6^{th}$ week

Analysis and Design of the Project: 3 Weeks ($7^{th}$ to $9^{th}$ week)

Project Review 2 Presentation: $10^{th}$ week

Report Writing, Documentation and Presentation: 2 Weeks ($11^{th}$ and $12^{th}$ week)

Project report assessment by the guide and review panel: 2 Weeks ($13^{th}$ and $14^{th}$ week)

Final Evaluation/Examination Presentation: $15^{th}$ week

**Project Demonstration (50 Marks)**

1. **Review 1 (05 marks)**
   - Demonstrate an ability to define precise Problem Statement, Project objectives and Scope, Project Planning, application of Project management tools.
2. **Project Activities (05 Marks)**
   - Demonstrate an ability to identify situations of unethical professional conduct and propose ethical alternatives.
   - Demonstrate Commitment towards practicing the Professional Ethics and moral.
   - Demonstrate an ability to apply the Code of Ethics
3. **Review 2 (Project Modeling and Designing, Block diagram, Flow chart, etc.) (10 marks)**
   - Write detailed Literature Review, Need and Significance of Study, Methodology, Block Dia- gram, Flow Chart, Engineering drawings, etc.
4. **Project Documentation (10 marks)**
   - Produce clear, well-constructed, and well-supported written engineering documents, project cost sheet and plagiarism report.
5. **Final project demonstration & Project team presentation (20 marks)**
   - Demonstrate effective communication,Implement the norms of standard professional prac- tices, Present results as a team showing the responsible behaviour.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Database Management System |
| | COURSE CODE | 2311216T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Foundation of Computing

**COURSE OBJECTIVES :**

2311216T.CEO.1: To learn basic concepts of database management system,database transaction pro- cessing,concurrency control and Recovery.

2311216T.CEO.2: To learn key notions of query evaluations and optimization techniques. 2311216T.CEO.3: To develop database design using ER diagram.

2311216T.CEO.4: To develop database design with integrity constraints and Trigger. 2311216T.CEO.5: To understand the normalization techniques.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311216T.CO.1: Illustrate the fundamental concepts of database management system, transaction pro- cessing,concurrency control and recovery. [L2]

2311216T.CO.2: Demonstrate key notions of query evaluations and optimization techniques. [L2].

2311216T.CO.3: Construct the ER model to solve the given problem[L3].

2311216T.CO.4: Design a well–formed relational database design(Schema) [L3]

2311216T.CO.5: Apply Normalization techniques to relational Schema[L3].

**COURSE ABSTRACT:**

A database management system is a software which allows creation,definition,and manipulation of the database,allowing users to store,process and analyse data easily. The course allows the learners with the learning of complete end to end development of an application developed using the UI and back end technologies.The data has to be mapped to different data models like the ER diagram,relational data model and then this has to be stored back into the database system.For effectively analyzing the stored data some query language is used. Here, in this course, the ORACLE or MYSQL can be used as a database system for storing and managing the data.The database must be created in such away that the data must be retrieved in an efficient manner. For this, the concept of normalization is applied to the database table. Finally, the ACID properties of any database application have to be maintained form a intaining the consistency of the data. The main objective of this course is to apply the basic operation of the database management system on the data generated through some application. Finally,the students must develop an end to end application considering some user requirements by applying front-end and back-end technologies.

**THEORY COURSE CONTENTS**

| UNIT 1 | INTRODUCTION | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Banking system,Student Information system using traditional file pro- cessing system

**Contents:** Introduction to Database system,Database System Vs file System,Data Abstraction, Instances and Schemas,Data Models- the ER Model,Relational Model,Other Models Mapping ER model to relational model. Case study ERD and Table design,System Structure,Database architec- tures:Centralized,Client Server,Parallel and Distributed Systems.

**Self Study:** Database Users and Administrator

**Further Readings:** Modeling concept for object oriented and object relational database.

| UNIT 2 | RELATIONAL MODEL | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Relational model for Banking system,University database

**Contents:** Structure of Relational Databases ,Database Schema,Schema Diagrams , Integrity Con- straints over Relations-Key Constraints,Foreign Key Constraints,General Constraints,Relational Query Languages–Relational algebra,Tuple relational calculus.

**Self Study:**:Equivalence of relational calculus and relational algebra.

**Further Readings:**Domain relational calculus.

| UNIT 3 | STRUCTURE QUERY LANGUAGE | 08 HOURS |
|---|---|---|

**Applications/Case Study:** SQL queries for Banking system, shop management system,Tiwtter data analysis

**Contents:** SQL Queries–Nested queries–Aggregate operators–Null values,Views,Index,PL/SQL block,exceptions,packages, looping,Concept of stored procedures,cursor,Triggers.

**Self Study:** Transaction control language–commit,Rollback,savepoints.

**Further Readings:**Recursive Queries

| UNIT 4 | DATABASE DESIGN AND QUERY PROCESSING | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Student Information system,Employee database system

**Contents:** Relational Database Design: Purpose of Normalization,Data Redundancy and Update Anomalies,Functional Dependencies. Decomposition–Armstrong's axiom. The process of Normaliza- tion: 1NF,2NF,3NF,BCNF.Query Processing:Overview,Measures of Query cost,Selection and Join op- erations,Evaluation of Expressions.

**Self Study:** Multi valued dependency,4NF

**Further Readings:**XML and web databases

| UNIT 5 | TRANSACTION MANAGEMENT | 08 HOURS |
|---|---|---|

**Applications/Case Study:** ATM system,Banking system

**Contents:** Basic concept of a Transaction, ACID Properties, Database Architecture, Concept of Schedule, Serial Schedule. Serializability: Conflict and View, Cascaded aborts Recoverable and Non- recoverable Schedules. Concurrency Control:Need Locking methods,Deadlocks,Time stamping Meth- ods. Different crash recovery methods: Shadow-Paging, Log-based Recovery: Deferred and Immedi- ate,CheckPoint.

**Self Study:** Buffer management and remote backup

**Further Readings:** ARIES Recovery

| UNIT 6 | NOSQL DATABASES | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Aadhar UIDAI system

**Contents:** Introduction to NOSQL database,Types of NoSQL Databases,ACID vs BASE,SQL vs No- SQL,MongoDB:Data Types,Documents,Collections,Database,CRUD Operations,Aggregation

**Self Study:** Pipeline and Indexing.

**Further Readings:** Multimedia Databases..

**TEXT BOOKS**


Silberschatz A.,Korth H.,Sudarshan S.Database System Concepts. 6th Edition,McGrawHill Pub- lishers,2006, ISBN978-0-07-352332-3.

Elmasri R., Navathe S., Fundamentals of Database Systems.4th Edition, Pearson, Education, 2003, ISBN8129702282D.

Pramod J Sadalage,Martin Fowler,NoSQL-Abrief guide to the Emerging World of Polyglot Per- sistence Distilled.Addison-Wesley, ISBN978-0-321-82662-6.

Raghu ramaKrishnan,Johannes Gehrke DatabaseManagement Systems3/e,TMH

**REFERENCE BOOKS**

Rab P.Coronel C.Database Systems Design, Implementation and Management. 5th Edition,

Connally T.,Begg C .Database Systems3rd Edition,Pearson Education,2002,ISBN81-7808-861 4M.

Thoms on CourseTechnology,2002, ISBN981-243-135-7. .Date C., An Introduction to Database Systems 7th Edition,Pearson Education, 2002,ISBN81-7808-23

H Garcia-Molina, JD Ullman and Widom, Database Systems: The Complete Book

**E-RESOURCES**

https://nptel.ac.in/courses/106106220

https://www.w3schools.com/sql/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Database Management System Lab |
| | COURSE CODE | 2311216L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Foundation of Computing

**COURSE OBJECTIVES :**

2311216L.CEO.1: To develop database design using ER diagram.

2311216L.CEO.2: To develop database design with integrity constraints and Trigger.

2311216L.CEO.3: To understand the normalization techniques.

2311216L.CEO.4: To understand CRUD operations on SQL and NoSQL database.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311216L.CO.1: Construct the ER model to solve the given problem [L3].

2311216L.CO.2: Design a well –formed relational database design(Schema) [L3].

2311216L.CO.3: Apply Normalization techniques to relational Schema [L3].

2311216L.CO.4: Execute CRUD operations on relational and non-relational database.[L3]

**COURSE ABSTRACT:**

A database management system is a software which allows creation, definition, and manipulation of the database, allowing users to store, process and analyse data easily. The course allows the learners with the learning of complete end to end development of an application developed using the UI and backend technologies. The data has to be mapped to different data models like the ER diagram, relational data model and then this has to be stored back into the database system. For effectively analyzing the stored data some query language is used. Here, in this course, the ORACLE or MY SQL can be used as a database system for storing and managing the data. The database must be created in such a way that the data must be retrieved in an efficient manner. For this, the concept of normalization is applied to the database table. Finally, the ACID properties of any database application have to be maintained for maintaining the consistency of the data. The main objective of this course is to apply the basic operation of the database management system on the data generated through some application. Finally, the students must develop an end to end application considering some user requirements by applying front-end and back-end technologies.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **.** | **4 HOURS** |
| Design and draw an ER/EER diagram using standard notations for given problem definition and convert this diagram into Database Tables.Be sure to underline all primary keys, include all necessary foreign keys and indicate referential integrity constraints | | |
| **PRACTICAL NO.02** | | **10 HOURS** |
| For above example use SQL DML statement such as INSERT,UPDATE and DELETE to insert the data into tables and to update/delete the data inserted into/from tables. Write and execute SQL queries to extract information from the table. | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Create and perform Database Operations using Oracle as Back End and Java as Front End.Use JDBC connectivity. | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| Implement following different types of PL/SQL blocks 1. Anonymous PL/SQLblock 2. Anonymous PL/SQL with cursor concept and Exception handling 3. Anonymous PL/SQL with For loop cursor concept4. Stored Procedure and Function 5.Trigger | | |
| **PRACTICAL NO.05** | **.** | **4 HOURS** |
| Design unstructured database and perform different operations on it. | | |
| **PRACTICAL NO.06** | **.** | **4 HOURS** |
| MINIPROJECT:Database Project Life Cycle Students have to complete a miniproject in agroup of minimum 3 and maximum 4 students.The problem statement for the project will be given to each group by the instructor in the first week of semester. Students can use either of the database systems (structured or unstructured)for completing their project . | | |

**TEXT BOOKS**

Silberschatz A.,Korth H.,Sudarshan S.Database System Concepts. 6th Edition,McGraw Hill Pub- lishers,2006, ISBN978-0-07-352332-3.

Elmasri R., Navathe S., Fundamentals of Database Systems.4th Edition, Pearson, Education, 2003, ISBN8129702282D.

Pramod J Sadalage,Martin Fowler,NoSQL-Abrief guide to the Emerging World of Polyglot Per- sistence Distilled.Addison-Wesley, ISBN978-0-321-82662-6.

Raghu ramaKrishnan,Johannes Gehrke DatabaseManagement Systems3/e,TMH

**REFERENCE BOOKS**

Rab P.Coronel C.Database Systems Design, Implementation and Management. 5th Edition,

Connally T.,Begg C .Database Systems3rd Edition,Pearson Education,2002,ISBN81-7808-861 4M.

Thoms on CourseTechnology,2002, ISBN981-243-135-7. .Date C., An Introduction to Database Systems 7th Edition,Pearson Education, 2002,ISBN81-7808-23

H Garcia-Molina, JD Ullman and Widom, Database Systems: The Complete Book

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY (ARTIFICIAL INTELLIGENCE ) | COURSE NAME | Machine Learning |
| | COURSE CODE | 2311217T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 15 | 20 | 40 | NIL | NIL | 75 |

**PREREQUISITE KNOWLEDGE:** Mathematical foundation for AI, Python programming

**COURSE OBJECTIVES :**

2311217T.CEO.1: To derive mathematical formulations of machine learning algorithms 2311217T.CEO.2: To Develop practical skills in various machine learning techniques.

2311217T.CEO.3: To analyze the performance of various approaches of machine learning algorithms.

2311217T.CEO.4: To handle techniques for evaluating and fine-tuning model performance.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311217T.CO. 1: Understand and apply regression and classification models to solve real-world prob- lems[L3]

2311217T.CO. 2: Apply unsupervised and ensemble models algorithm to solve real world problem [L3]

2311217T.CO. 3: Implement probabilistic models. [L3]

2311217T.CO. 4: Analyze and Evaluate practical challenges in machine learning, including bias- variance trade-offs, overfitting, regularization in AI applications.[L5]

**COURSE ABSTRACT:**

This course provides a comprehensive introduction to machine learning, covering fundamental concepts, algorithms, and practical applications. Students will explore key topics such as supervised and unsuper- vised learning, and ensemble learning. By the end of the course, students will be able to build predictive models, evaluate algorithm performance, and apply machine learning techniques to real-world problems in various domains.

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **FUNDAMENTALS OF MACHINE LEARNING AND RE- GRESSION ANALYSIS** | **06 HOURS** |

**Applications/Case Study:** Healthcare Diagnosis

**Contents:** Introduction of machine learning, history, and applications. Types of machine learning: Supervised, unsupervised, reinforcement learning. Life cycle of machine learning. Regression,Types of regression: Simple and Multiple Linear Regression, Evaluation Metrics for Regression Models: Mean squared error,root mean squared error, mean absolute error, and R-squared value. Gradient descent Algorithm, Bias variance trade-off, Overfitting Under fitting, Regularization Generalization.

**Self Study:** Cross-validation

**Further Readings:** Stochastic Gradient Descent

| | | |
|---|---|---|
| **UNIT 2** | **CLASSIFICATION MODELS** | **07 HOURS** |

**Applications/Case Study:** Spam Email Classification

**Contents:** Logistic regression, Model Evaluation Metrics: Accuracy, Precision, Recall, F1, Confusion matrix, K-Nearest-Neighbor Algorithm, Support Vector Machine (SVM), Decision Tree, Naive Bayes classifier.

**Self Study:** Weighted KNN

**Further Readings:**Support Vector Regression (SVR)

| UNIT 3 | UNSUPERVISED LEARNING | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Dimensionality Reduction for any dataset

**Contents:** Introduction to Clustering, Partitional Clustering,Hierarchical Clustering,Density Based Clustering.Gaussian Mixture Models, Dimensionality Reduction, Feature Selection and Extraction, Principal Component Analysis. Linear Discriminant Analysis (LDA).
**Self Study:** Manifold Learning

**Further Readings:**Evaluation Metrics for Clustering (Silhouette Score,Davies-Bouldin Index)

| UNIT 4 | ENSEMBLE LEARNING | 04 HOURS |
|---|---|---|

**Applications/Case Study:** Credit Card Fraud Detection

**Contents:** Random Forests, types: Bagging and boosting Bagging and boosting, different algorithms and libraries (Adaboost, GB, XGB)
**Self Study:** CatBoost

**Further Readings:**LightGBM

| UNIT 5 | PROBABILISTIC MACHINE LEARNING | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Bayesian time series models for predicting product demand.

**Contents:** Review on concepts in probability and statistics; Bayesian concept learning; Exponential family; Directed graphical models; Gaussian models; Generalized linear models; Learning with hidden variables, Kernel methods; Gaussian processes; Markov random fields;
**Self Study:** Bayesian linear regression

**Further Readings:** Variational Inference (VI) in Probabilistic Machine Learning.

**TEXT BOOKS**


Shivashankar B. Nair, Artificial Intelligence,. 3rd Edition, TataMcGraw Hill. ISBN-13: 978-0- 07-008770-5.

Ethem Alpaydin(2020). Introduction to Machine Learning. 4th Edition,The MIT Press publica- tion. ISBN:978-0-262-04379-3.

Machine Learning -The Art and Science of Algorithms that Make Sense of Data, Peter Flach

Tom Mitchell(1997). Machine Learning. 2nd Edition, Tata McGraw-Hill publication, ISBN 007- 0-42807-7.

Jason Bell(1994). ”Machine Learning: Hands-On for Developers and Technical Professionals. 2nd Edition,Willey Publication,ISBN-10: 8126553375, ISBN-13: 978- 8126553372.

James, G., Witten, D., Hastie, T. and Tibshirani, R(2013). An Introduction to Statistical Learn-

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY ARTIFICIAL INTELLIGENCE | COURSE NAME | MACHINE LEARNING LAB |
| | COURSE CODE | 2311217L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

| PRACTICALS : :Perform following experiments using python programming language | | |
|---|---|---|
| **PRACTICAL NO.01** | **Linear And Logistic Regression Model** | **6 HOURS** |
| To implement and evaluate Linear Regression, Multiple Linear Regression, and Logistic Regression models using Python on a dataset, covering the following:<br>1. Data Preprocessing Splitting<br>2. Model Training Evaluation (Intercept and Slope)<br>3. Visualization of Training Testing Sets<br>4. Prediction on Test Data<br>5. Comparison of Actual vs. Predicted Values | | |
| **PRACTICAL NO.02** | **Classification Model** | **6 HOURS** |
| To implement and evaluate k-Nearest Neighbors and Support Vector Machines, Decision tree algorithms using Python on a dataset, covering the following:<br>1. Select a dataset of your choice for classification.<br>2. Implement the classifier algorithm on selected dataset.<br>3. Train and evaluate the model using appropriate performance metrics<br>4. Visualize decision boundaries to understand classification behavior. | | |
| **PRACTICAL NO.03** | **Unsupervised Learning** | **4 HOURS** |

1. Implement K-means clustering and Hierarchical clustering for selected dataset. Compute the following,
   (a) K-Means: Compute the squared error for k=3 and k=4 clusters
   (b) K-Means: Find optimum number of clusters
   (c) compute (and store) the squared errors of all possible clustering in hierarchical clustering Compare k-means and hierarchical clustering with respect to error and optimum number of clusters.
2. Implementation of Principal Component Analysis (PCA) for Dimensionality Reduction
   (a) Apply PCA on a chosen dataset to reduce its dimensionality.
   (b) Analyze the variance explained by each principal component.
   (c) Visualize the transformed data in a lower-dimensional space (e.g., 2D or 3D scatter plot).

| PRACTICAL NO.04 | Probabilistic Models (Any 2) | 6 HOURS |
|---|---|---|

1. Email Spam Filtering using Na¨ıve Bayes Classifier
   (a) Design and implement a Na¨ıve Bayes classifier for email spam detection.
   (b) Train the model on a selected dataset and evaluate its accuracy using appropriate perfor- mance metrics (e.g., precision, recall, F1-score).
   (c) Analyze the effectiveness of the classifier by comparing its performance on spam vs. non- spam emails.
2. Implementation of Bayesian Belief Network (BBN)
   (a) Construct and implement a Bayesian Belief Network for probabilistic reasoning.
   (b) Train the network on a selected dataset and infer the probability of specific outcomes.
   (c) Demonstrate real-world applications where BBN can be effectively utilized.
3. Implementation of Random Forest and AdaBoost on Heart Disease Dataset
   (a) Implement both Random Forest and AdaBoost classifiers to predict heart disease.
   (b) Compare the performance of both models using evaluation metrics such as accuracy, AUC- ROC, and confusion matrix.
   (c) Analyze feature importance to understand the key predictors of heart disease.

| PRACTICAL NO.05 | Mini Project (Ensemble Learning) | 8 HOURS |
|---|---|---|

Problem Statement: Individual ML models often struggle with accuracy and generalization. This project implements and compares Bagging (Random Forest), Boosting (XGBoost, AdaBoost, Gradient Boosting), and Stacking to enhance predictive performance on a real-world dataset. Follow the tasks given

1. Dataset Selection Preprocessing (handling missing values, feature scaling, encoding).
2. Model Implementation: Train base models (Decision Trees, SVM, KNN) and apply ensemble techniques.
3. Performance Evaluation using accuracy, precision, recall, F1-score, RMSE, and ROC-AUC.
4. Results Conclusion: Analyze improvements through ensemble learning and select the best- performing model.

**TEXT BOOKS**

Ethem Alpaydin(2020). Introduction to Machine Learning. 4th Edition,The MIT Press publica- tion. ISBN:978-0-262-04379-3.

Machine Learning -The Art and Science of Algorithms that Make Sense of Data, Peter Flach

Tom Mitchell(1997). Machine Learning. 2nd Edition, Tata McGraw-Hill publication, ISBN 007- 0-42807-7.

Jason Bell(1994). "Machine Learning: Hands-On for Developers and Technical Professionals. 2nd Edition,Willey Publication,ISBN-10: 8126553375, ISBN-13: 978- 8126553372.

James, G., Witten, D., Hastie, T. and Tibshirani, R(2013). An Introduction to Statistical Learn- ing,Springier Publication,VOl 112.

Reinforcement Learning: An Introduction (Adaptive Computation and Machine Learning

**REFERENCE BOOKS**

Peter Harrington (2012)Machine Learning in Action. 2nd Edition, Dreamtech Press,ISBN 978-1- 617-29018-3.

Trevor Hastie,Robert Tibshirani, Jerome Friedman. The Elements of Statistical Learning: Data Mining,Inference and Prediction 3rd Edition,ISBN: 978-0-387-84857-0.

Christopher M. Bishop(2016)"Pattern Recognition and Machine Learning. 4th Edition, Springier New York.

Andrea's Muller.Introduction to Machine Learning with Python: A Guide for Data Scien- tists(2016),1st Edition,Shroff/O'Reilly,ISBN-10: 9352134575, ISBN-13: 978-9352134571.

Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar Foundations of Machine

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | COMPUTER NETWORK |
| | COURSE CODE | 2311218T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Data Structure, Discrete Structures and Graph Theory

**COURSE OBJECTIVES :**

2311218T.CEO.1: To build understanding of fundamental concepts of data communication and net- working.

2311218T.CEO.2: To differentiate between network types typologies. 2311218T.CEO.3: To explore routing algorithms applications in various scenarios. 2311218T.CEO.4: To classify connection oriented and connection-less services.

2311218T.CEO.5: To explore current trends in networking technologies.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311218T.CO.1: Utilize signals and communications types with respect to network infrastructure. [L3] 2311218T.CO.2: Build different types of network topologies and protocols. [3]

2311218T.CO.3: Evaluate routing protocols for different real time systems.[5] 2311218T.CO.4: Analyze connection oriented and connectionless services.[L4] 2311218T.CO.5: Demonstrate different application/systems related to networking.[L3]

**COURSE ABSTRACT:**

A computer network is a set of computers connected together for the purpose of sharing resources. The most common resource shared today is connection to the Internet. Other shared resources can include a printer or a file server.

This course deals with fundamentals of computer network. It deals with various network models, types and OSI layers. This course provides uses of computer network, role of seven OSI layers for wire oriented and wireless communication.

At the end of the course, the students will be able to build an understanding of the fundamental concepts of computer computer networks, networking concepts, network standards protocols, fundamental network security etc.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **Physical Layer** | **09 HOURS** |

**Applications/Case Study:** E-Mail System, Digital Speedometer, Multiuser Network Games
**Contents:** Data Communications, Networks, Network Types: LAN,MAN, WAN, Wireless mesh net- work, Hybrid wireless networks Protocol Layering, The OSI Model, TCP/IP Protocol Suite, Data and Signals, Periodic analog signals, Digital Signals, Transmission Impairments, Data rate limits, Perfor- mance, Line Coding , Line Coding Schemes : Unipolar, Polar, Bipolar
**Self Study:** Standards And Administration
**Further Readings:** Transmission Modes.

| **UNIT 2** | **Data Link Layer** | **09 HOURS** |
|---|---|---|

**Applications/Case Study:** WinRAR, WinZip
**Contents:**Introduction: Nodes and Links, Services, Two categories of links, Two sublayers , Link Layer addressing: Three types of addresses, Address Resolution Protocol(ARP), Error detection and correc- tion: Types of errors, redundancy, Detection Vs Correction, Coding, Block Coding: Hamming codes
,Cyclic Redundancy Check, Data Link Control and Services: Framing, Flow Control, Connectionless and Connection-Oriented, Data Link Layer Protocols : Simplest Protocol, Stop and Wait Protocol , Piggybacking , Stop-and-Wait ARQ ,Sliding Window Protocols: GO-Back-N ARQ, Selective-Repeat ARQ, Random Access: CSMA,CSMA/CD,CSMA/CA, Media access protocol for Wireless LAN
**Self Study:** Standard Ethernet
**Further Readings:** Wi-Max(IEEE Project 802.16).

| UNIT 3 | Network Layer | 09 HOURS |
|---|---|---|
| **Applications/Case Study:** Team viewer, Windows Remote Desktop Connection<br>**Contents:** Introduction, Network Layer Services: Packetizing, Routing and Forwarding, Other Ser- vices, Packet Switching: Datagram Approach: Connectionless Service, Virtual-Circuit Approach: Connection-Oriented Service, Network-layer Performance: Delay, Throughput, Packet loss, IPv4 Ad- dresses: Address Space, Classful addressing, Classless Addressing, Dynamic Host Configuration Pro- tocol(DHCP), Network Address Translation(NAT), Internet Protocol(IP) , Internet Control Message Protocol(ICMPv4), Routing Algorithms: Distance-Vector Routing, Link-State Routing, Path-Vector Routing, Wireless routing protocol, Ad-hoc on demand Distance vector RP,<br>**Self Study:** Multicast Routing(tree based multicasting and Zone based multicasting)<br>**Further Readings:**Internet Group Message Protocol(IGMP). | | |
| **UNIT 4** | **Transport Layer** | **06 HOURS** |
| **Applications/Case Study:** Microsoft Team, Cisco Webex, Google Hangout<br>**Contents:** Introduction: Transport Layer Services, Connectionless and Connection-Oriented Proto- cols, Transport-Layer Protocols: Services, Port Numbers, User Datagram Protocol(UDP): Datagram, Services, Applications, Transmission Control Protocol(TCP): Services, Features, Segment, Connection, Applications, Socket Programming, Ad-hoc TCP<br>**Self Study:** Application Controlled Transport Protocol (ACTP)<br>**Further Readings:**Real Time Transport Protocol (RTP) | | |
| **UNIT 5** | **Application Layer** | **06 HOURS** |
| **Applications/Case Study:** Moodle Server, FileZilla, IP messenger, WhatsApp<br>**Contents:** Introduction: Providing Services, Application-Layer Paradigms, Domain Name System (DNS), Hypertext Transfer Protocol (HTTP), Simple Mail Transfer Protocol (SMTP), File Transfer Protocol (FTP).<br>**Self Study:** Simple Network Management Protocol (SNMP)<br>**Further Readings:** TerminaL Network(TELNET),Secure Shell(SSH) | | |
| **UNIT 6** | **Networking Trends** | **06 HOURS** |
| **Applications/Case Study:** VOIP, IoT<br>**Contents:** Introduction, Software Defined Networking(SDN): Concept, Architecture, Communication, Application, Network Security: Policy - Integrity , Confidentiality, Availability , Privacy, Overview Data Centric Networks, Secure routing in Ad-Hoc network: Requirements and Security aware Ad Hoc Routing protocol<br>**Self Study:** SD-WAN<br>**Further Readings:** Platform for Privacy Preferences(P3P). | | |

**TEXT BOOKS**

Behrouz A. Forouzan, (2022) ”Data Communications and Networking”, 6th edition, Tata McGraw-Hill Publications, 2013

Doulas E. Comer, (2016) ”Computer Networks and Internets, 6th edition, Pearson Education Limited, ISBN 978-1292061177

**REFERENCE BOOKS**

. Andrew S. Tanenbaum, David J. Wetherall, (2022) ”Computer Networks”, 5thedition, Pearson Education India, ISBN 978-9332518742.

Larry L. Peterson Bruce S. Davie, (2011) “Computer Networks”, 4th edition, Morgan Kaufmann Publisher, ISBN 978-0-12-370548-8

William Stallings, (2020) ”Data and Computer Communications”, 9thedition, Pearson Education India, 2013, ISBN 978-9332518865

4. Behrouz A. Forouzan, (2013) ”Data Communications and Networking”,5th edition,

**E-CONTENTS/VIRTUAL LAB/ONLINE SIMULATOR LINKS**

1. https://nptel.ac.in/courses/106106091

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Object Oriented Programming (Core Java) |
| | COURSE CODE | 2311268L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE KNOWLEDGE :** Problem Solving Using OOP(CPP)

**COURSE OBJECTIVES :**

2311268L.CEO.1: To design and program stand-alone Java applications.
2311268L.CEO.2: To extend Java classes with inheritance and dynamic binding.
2311268L.CEO.3: To use exception handling and file handling in Java applications.
2311268L.CEO.4: To design a graphical user interface (GUI) with Java Swing.
2311268L.CEO.5: To implement database applications.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311268L.CO.1: Implement Object Oriented Programming Concepts in java. [L3] 2311268L.CO.2: Construct packages and interfaces in Java[L3]
2311268L.CO.3: Develop GUI-based java applications. [L3]
2311268L.CO.4: Utilize logic building traits efficiently for solving real life problems. [L3]
2311268L.CO.5: Implement applications using JDBC [L3]

**COURSE ABSTRACT:**

Core Java is the Skill Development Course. The basic aim of the course is to introduce the students to Object Oriented Programming using Java. and make their concepts clear for designing real time applications using the same. The inclusion of Challenging Problems in the course will enhance students' logical thinking and boost their analytical skills. Various stages in problem solving will help students to deal with complex problems easily. This course will improve students problem solving abilities and coding skills.

**CONTENTS :**

Basics of Java, Data Types and Variables, Operators, Control Statements,Looping, Arrays; String, String Buffer, String Builder; Methods, Lambda Expression, Constructor; Object Oriented Program- ming System : Classes and Objects, Modifiers, Inner Classes; Inheritance; Super,This,Static and Final Keywords; Polymorphism: Method Overloading, Method Overriding; Abstraction, Interfaces; Excep- tion Handling, Create Own Exceptions; Multi threading ; Packages, Collections Framework; File Han- dling; Generics; Introduction to Swing: Layout Management , Swing Components ,Text Fields , Text Areas ,Buttons, Check Boxes, Radio Buttons , Lists, Choices, Scroll bars , Windows ,Menus , Dialog Boxes. JDBC Programming .

Self Study: Bytecode in Java ,Bytecode vs Machine code, JRE, Java API, JVM in Java, JVM Archi- tecture, Class Loader,Interpreter in Java Interpreter vs Compiler,Download Install Java Development Kit JDK,Download Eclipse IDE for Java Developers.

**PRACTICAL: All assignments should be performed considering real-world applications.**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **FUNDAMENTALS OF JAVA** | **6 HOURS** |

a) Write a program based on the basics of Java

b) Implement a program using Control Statement, Looping, Array

c) Program for implementing string operations

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **CLASS-OBJECT, METHODS, CONSTRUCTORS** | **6 HOURS** |

a) Write a program to create Class, declare Member Variables, Define Methods

b) Program to define Constructor, Passing Information to a Method or a Constructor.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **JAVA INHERITANCE** | **4 HOURS** |

a) Program to implement all types of Inheritance

b) Write a Java program to create a base class Sports with a method called play(). Create three subclasses: Football, Basketball, and Rugby. Override the play() method in each subclass to play a specific statement for each sport.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **STATIC, FINAL , SUPER AND THIS KEYWORD** | **2 HOURS** |

a) Program to implement static, final , super and this keyword in java

| PRACTICAL NO.05 | POLYMORPHISM | 4 HOURS |
|---|---|---|
| a) Program to implement polymorphism<br>b) Write a Java program to create a class Vehicle with a method called speedUp(). Create two subclasses Car and Bicycle. Override the speedUp() method in each subclass to increase the vehicle's speed differently. | | |
| **PRACTICAL NO.06** | **JAVA ABSTRACT CLASS, INTERFACES, LAMBDA EXPRESSION** | **4 HOURS** |
| a) Write a program based on Abstract Class<br>b) Write a program based on Interfaces<br>c) Program to define lambda expression | | |
| **PRACTICAL NO.07** | **EXCEPTION HANDLING** | **4 HOURS** |
| a) Implement a program to handle different exceptions<br>b) Implement a program to create own exception class | | |

| PRACTICAL NO.08 | JAVA THREAD | 4 HOURS |
|---|---|---|
| a) Write a Java program to create a basic Java thread that prints ”Hello, World!” when executed.<br>b) Write a Java program that creates two threads to find and print even and odd numbers from 1 to 20. | | |
| **PRACTICAL NO.09** | **PACKAGES AND COLLECTIONS** | **4 HOURS** |
| a) Implement a program to create own package<br>b) Implement a program based on Java collections | | |
| **PRACTICAL NO.10** | **FILE HANDLING** | **4 HOURS** |
| a) Write a Java program to get a list of all file/directory names in the given directory.<br>b) Write a Java program to read file content line by line. | | |
| **PRACTICAL NO.11** | **JAVA SWING** | **4 HOURS** |
| a) Write a program to create Frame and make use of Layout Management, User Interface Components<br>b) Write a program to create GUI based application using swing | | |
| **PRACTICAL NO.12** | **JDBC** | **6 HOURS** |
| a) Write a JDBC application which will interact with Database and perform the following task.<br>1) Create Student Table with RollNo, Name, and Address field and insert few records.<br>2) Display the content of Record.<br>3) Insert Two Records.<br>4) Update One Record.<br>5) Delete One Record. | | |
| **PRACTICAL NO.13** | **JAVA GENERICS** | **2 HOURS** |
| a) Write a Java program to create a generic method that takes two arrays of the same type and checks if they have the same elements in the same order<br>b) Write a Java program to create a generic method that takes a list of numbers and returns the sum of all the even and odd numbers. | | |

| PRACTICAL NO.14 | Mini Project: Sample Topics | 6 HOURS |
|---|---|---|

a) Energy billing system

b) Medical store stock management system

c) Gaming Application

d) Library book issue management system

e) Restaurant Management System

f) Online bus reservation system

Implement Using: The concept of Swing and JDBC

**Instructional Method**

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by white board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

The internal evaluation will be done on the basis of continuous evaluation of students

A Practical examination will be conducted at the end of the semester for evaluation of the performance of students in the laboratory.

Students will use supplementary resources such as online videos, NPTEL videos, e-courses, and Virtual Laboratory

Only one mini-project is planned to be undertaken by a student. Groups have to be formed for a project, the number of students in the group should not exceed three.

Each project should encompass two or three COs. The students need to give the project

**TEXT BOOKS**

Herbert Schildt.(2021). “Java The complete reference”, 12th Edition, McGraw Hill Education.

Cay S. Horstmann, Gary cornell.(2021). “Core Java Volume –I Fundamentals”, 12th

**REFERENCE BOOKS**

K. Arnold and J. Gosling. (2005).“The JAVA programming language”, Fourth edition, Pearson Education.

Timothy Budd. (2000). “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education.

C. Thomas Wu. (2006). “An introduction to Object-oriented programming with Java”, Fourth Edition, Tata McGraw-Hill Publishing company Ltd.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Enterprise Application Development(Advance Java) |
| | COURSE CODE | 2311269L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** 2304262 Problem Solving Using OOP(Java)

**COURSE OBJECTIVES :**

2311269L.CEO.1: To Apply the core Java fundamentals to learn the advanced concepts in J2SE

2311269L.CEO.2: To make use of Servlet and JSP API in the process of enterprise application deployment

2311269L.CEO.3: To Development of web application having collaboration of Servlets, JSPs, JSF, Spring and Hibernate based upon

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2311269L.CO.1: Construct java applications using OOP, JDBC and multithreading concepts. [L3]

2311269L.CO.2: Utilize Servlet and JSP API in the process of enterprise application deployment. [L3]

2311269L.CO.3: Build web application using Servlets, JSPs, JSF, Spring, Hibernate, and database, based upon the requirement. [L3]

2311269L.CO.4: Develop programs using socket programming [L3]

**COURSE ABSTRACT:**

Advanced Java (2304269) is the Skill Development Course offered for SY BTECH Students. Based on object-oriented concepts and Advanced Java concepts, this course will equip the students with the required knowledge and skill of object-oriented programming approach needed for the development of robust, powerful web applications. This course develops the programming ability of students to create dynamic web applications using server-side technology with Java Database Connectivity. Students can learn networking and remote method invocation using Java API. Different Java frameworks like Spring, Java Server Faces, and Hibernate will increase the ability of students in web application development.

**CONTENTS :**

1. J2EE and Web Development
2. JDBC Programming
3. Multithreading
4. Networking
5. Servlet
6. Java Server Pages (JSP)
7. Hibernate
8. Java Web Frameworks: Spring
9. Java Server Faces

**PRACTICAL: All assignments should be performed considering real-world applications.**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Core Java Fundamentals** | **4 HOURS** |

a) Write a program using Exception Handling, Abstraction, and Package

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **JDBC** | **4 HOURS** |

a) Write a JDBC application which will interact with Database and perform the following task.

1) Create Student Table with RollNo, Name, and Address field and insert few records.
2) Display the content of Record.
3) Insert Two Records.
4) Update One Record.
5) Delete One Record.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Multithreading** | **6 HOURS** |

a) Implement a program to Create thread, scheduler, thread methods all

b) Program to implement thread using runnable interface and creating multiple thread

c) Write a program to priorities of thread, Thread pool, thread group.

| PRACTICAL NO.04 | Networking | 6 HOURS |
|---|---|---|

| | | |
|---|---|---|
| a) Write a program to retrieve IP address for given website and content of the given URL<br>b) Implement a program to two – way network based chat application using TCP/IP.<br>c) Implement a program to connection-oriented communication and connection-less communication. | | |
| **PRACTICAL NO.05** | **Servlet** | **8 HOURS** |
| a) Write a program for simple servlet, testing servlet and deployment descriptor<br>b) Implement program using doget and doPost method, life cycle of servlet.<br>c) Write a program to create servlet file for different database operation.<br>d) Implenet a program for error handling, authentication and context interface | | |
| **PRACTICAL NO.06** | **Java Server Pages (JSP)** | **6 HOURS** |
| a) Write a program based on JSP actions and Objects<br>b) Implement a program for cookies handling and session tracking<br>c) Write a program to demonstrate the core, format, function, and SQL tags of JSTL | | |
| **PRACTICAL NO.07** | **Hibernate** | **6 HOURS** |
| a) Program to implement Hibernate.<br>b) Implement Hibernate Annotations.<br>c) Implement Hibernate Query Language and types of relation | | |
| **PRACTICAL NO.08** | **Java Web Frameworks: Spring** | **8 HOURS** |
| a) Write a program to implement MVC using Spring Framework.<br>b) Write a program for Inject Service using Aspect Oriented Programming.<br>c) Implement Jdbc Template,Spring ORM, Spring MVN<br>d) Implement a program for Spring Template manages, Spring Transaction Management, Spring Restful Services | | |
| **PRACTICAL NO.09** | **Java Server Faces** | **6 HOURS** |
| a) Write a program for JSF Standard Components and Facelets Tags.<br>b) Write a program for JSF Converter Tag and Validation Tags. | | |
| **PRACTICAL NO.10** | **Mini Project: Sample Topics** | **6 HOURS** |

a) Energy billing system

b) Medical store stock management system

c) Library book issue management system

d) Restaurant Management System

e) Online bus reservation system

**TEXT BOOKS**

Java Server Programming Java EE 7 (J2EE 1.7), Black Book

Complete Reference J2EE by James Keogh mcgraw publication

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: (Rev. 2023(NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | ENVIRONMENTAL SCIENCE |
| | COURSE CODE | 2301286T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | NEP |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301286T.CEO.1: To study a fundamental and ecological concept of environment.

2301286T.CEO.2: To enable students to have a nuanced understanding of environmental pollution, solid waste management and climate change and to act with concern on environmental issues.

2301286T.CEO.3: To develop a sense of responsibility towards society and the environment.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2301286T.CO.1: Demonstrate the importance of ecosystem and biodiversity for maintaining ecological balance [L3].

2301286T.CO.2: Identify different types of environmental problems and their control measures [L3].

2301286T.CO.3: Apply environmental legislation and sustainable development concept [L3].

**COURSE ABSTRACT:**

This course provides an overview of the significance of ecosystems, including environmental pollution, biodiversity and its conservation, and environmental law. Discussions of environmental issues begin with climate change, global warming, and other environmental challenges. A model for the generation of Power as Solar, Wind, and Water is required for students as part of the Green Energy Corridor Project creative exercise. Students will do a brief project on any environmental idea to help them build a positive attitude towards the environment, such as the reuse, recycle, and reduce principle, environ- mental pollution monitoring and control, the material balance principle, sustainable development, or environmental innovations.

**THEORY**

| **UNIT 1** | **Overview of Environment: Field Study (Minimum 2)** | **06 HOURS** |
|---|---|---|

**Theory Content**: Concept of Ecology and Environmental Science, Biogeochemical cycle, Ecosystem and its management. Fate of Environmental Pollutant, Environmental status, Effect on climate change. **Student will present in the following stages for the activities.**

- Stage I Inception (2 Hours)
- Stage II Data Collection (2 Hours)
- Stage III Analysis (2 Hours)

**Activity No: 1 (Group activity includes, only 5 members, Geo-tag photos, Detailed site visit report)**

Students have to visit any one nonhazardous polluted site for finding the various reasons of its pollution and suggest preventive measures for it.

Non Hazardous Site includes any of the following place:

- River
- Solid Waste Treatment Plant
- Garbage collection points
- Industries
- Site which comes under either of Soil, Water, Air or Industrial pollution

Visit report must content Geotag Photos and detailed site visit record. Visit can be done in a group up to 4 members only.

**Activity No: 2 (Individual activity)**

To describe the climate of an urban area by analyzing hourly variation of NCAP(National Clean Air Program) acclaimed Pollutant in the same area.

**Activity No: 3(Group activity)**

Environmental awareness programs under Swatch Bharat Mission like, Sachet Hi Sews, Swachhta pakhwada, Special Drive before Diwali, organizing essay competition, poster competition, slogan mak- ing competition, Awareness about minimum electricity consumption in campus, Celebrating various Environmental Days.

| UNIT 2 | Environmental Pollution (Minimum 3) | 08 HOURS |
|---|---|---|

**Theory Content**: Environmental Pollution: Air, Water, Soil, Solid and Hazardous Waste Manage- ment; Environment and human health, Over utilization of natural resources, Environmental Legislation, Environmental monitoring organizations in India, Environmental Protection Agency (EPA).

**Activities:**

1) Activity No. 1 Determination of PH and Electrical Conductivity of Water Sample.
2) Activity No. 2 Segregation of waste from source. (Visit to garbage segregation disposal site)
3) Activity No. 3 Measurement of noise using sound level meter.
4) Activity No. 4 Study of soil property, Temperature, Texture and Particle Size.

| UNIT 3 | Creative Exercise : Global Environmental Issues (Any One) | 08 HOURS |
|---|---|---|

**Theory Content**: Introduction to climate change, Global warming, Acid rain, Ozone layer depletion, Plastic waste management, Municipal solid waste management, Food problem, E-waste management, Social Issues: Environmental ethics and economics. (This content is for reference during practical) **Creative Activities:**

1) The Green Energy Corridor Project Develop lab working model alternatives to renewable energy sources like solar, wind, and water for the production of power.
2) Use of social media platform for E networking and Dissemination of ideas on Environmental Issues.
3) Study of 8 National Missions on climate change as per National Action Plan on Climate Change (NAPCC), GOI.
4) Make a report on UN Goals on sustainability and also different effective measures were taken for the

Conservation of Rivers in India.

| UNIT 4 | Project Work (Compulsory) | 08 HOURS |
|---|---|---|

**Project work Description:**

Students have to identify the real life environmental problems from their daily observations and try to find out the various feasible solutions for it as their project work. They are supposed to prepare the prototype, demonstration model, detailed report and present it to the evaluators. The project topic should be related to the below mentioned heads:

1) Reduce, Reuse, Recycle.
2) Environmental Pollution Monitoring and Control Material

Balance Concept. 3)Sustainable Development.

4)Environmental Innovations.

The evaluation is based on at least one number of project presentation reviews apart from the final project presentation.

Participation and Certification of Student groups into Any International/National/State/Regional Level competition organized by any Government/Private Agency, NGO's, Consultancy related to Environmen- tal Concerns.

**Rubrics for evaluation of 40 marks, of project-based learning.**

| Month Of Assessment | Assessment task | Marks |
|---|---|---|
| 1 st month | Group of 4 Members Defining objectives methodologies literature review | 10 marks |
| 2 nd month | Model development Poster making | 10 marks |
| 3 rd month | Report preparation and Plagiarism | 10 marks |
| 4 th month | Final presentation | 10 marks |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Entrepreneurship Skills |
| | COURSE CODE | 2301276 |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | NEP |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | 2 | Nil | Nil | 25 | 20 | 30 | 75 |

PREREQUISITE: Nil

**COURSE OBJECTIVES :**

2301276.CEO.1: To create awareness regarding entrepreneurship and encourage for selecting entrepreneurship as career option.

2301276.CEO.2: To provide exposure to the philosophies used in startup culture. 2301276.CEO.3: To introduce a basic pathway to become an entrepreneur.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301276.CO.1: Prepare a venture concept by identifying a problem /opportunity through survey [L3].

2301276.CO.2: Devise a value preposition canvas [L4].

2301276.CO.3: Propose a minimum viable product [L5].

2301276.CO.4: Demonstrate the balance sheet estimation for venture [L3].

| COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **Building Entrepreneurial mindset** | **6 HOURS** |
| Skills required for entrepreneurs, Common misconceptions about entrepreneurship, Dealing with Am- biguity, team formation.<br>**Self study**: Technology readiness levels systems. | | |
| **UNIT 2** | **Problem Identification and Opportunity Discovery** | **8 HOURS** |
| Analysis of different aspects of the venture concept, Revisiting the Problem Statement, Calibrate the Problem Statement on the 'Great Problem Litmus Test', composing the Problem Pitch.<br>**Case Study**: Desi Hangover-the shoe story.<br>**Assessment Activity**: Milestone 1 - Create a Value Proposition Canvas tat describes the venture concept and addresses a specific problem/ opportunity [CO1]. | | |
| **UNIT 3** | **Customer and Markets** | **7 HOURS** |
| Market Identification, Customer segmentation, Carving a Niche for identified opportunity, Market sizing, creating a Customer Persona.<br>**Case Study:** Verloop's story on customer acquisition and growth marketing strategies.<br>**Home assignments:**<br>1. Craft your value proposition .<br>2. Create a Value Proposition Canvas.<br>3. Create a sustainable differentiation strategy. | | |
| **UNIT 4** | **Competitive Advantage** | **6 HOURS** |
| Concept of competition, collecting information about the competition, running a competitive analysis, categories of competition, contribution of the competition in the company's success.<br>**Case Study:** How Inzpira personalized communicative English training with a competitive advantage approach.<br>**Assessment Activity**: Milestone 2 - Build the Lean canvas and create MVP version/s Proposing a<br>minimum viable product[CO2, CO3]. | | |
| **UNIT 5** | **Business model and MVP** | **6 HOURS** |
| Business model and the existing types, selection of business model suitable for the venture, Building the Lean canvas, Creating a Minimum Viable Product, Test the MLP.<br>**Case Study:** The Story of Knorish- How did India's Leading Course Creator Platform Build Its MVP.<br>**Home assignments:** Build the Lean canvas and create MVP version/s.<br>**Assessment Activity**: Milestone 3 - Presentation on financial planning and forecasting that estimates the balance sheet of the venture [CO4]. | | |

| UNIT 6 | Financial Feasibility and building brand in the market | 6 HOURS |
|---|---|---|

Financial planning, Components of a financial plan, Building financial plan and projections, Building the Go-To-Market strategy, Building and Positioning the brand, digital marketing plan.

**Case Study:**

1. How Bodh Gems and Crystals managed and tracked their costs to transform their passion into a profit-making business.
2. How Data Sutram piggybacked on the right channels to scale their business Next Generation Entrepreneur.

**Home assignment:** Presentation on financial planning and forecasting.

| UNIT 7 | Managing growth and funding strategy | 6 HOURS |
|---|---|---|

Devising a Growth Plan, Structure the Scaling Strategy, Devise a Customer acquisition strategy, Mon- itor KPIs and enhance Productivity via Process improvements, Operational Excellence, and Managing Sales Distribution, Identifying funding sources, Mapping Start-Up Cycle to Funding Options, Creating business valuation.

**Case Study:**

1. Torchit's social entrepreneurship brought in a revolution and impacted millions of lives.
2. Growing at 100x with 100X.VC The Art of Fundraising Home assignment: Presentation on growth and funding strategy ur.

**Assessment Activity**: Milestone 4 - Presentation on growth and funding strategy [CO4].

**REFERENCE BOOKS**


1. Masters, B., Thiel, P. (2014). *Zero to one: notes on start ups, or how to build the future*. Random House.
2. Ferriss, T. (2017). *Tools of titans: The tactics, routines, and habits of billionaires, icons, and world-class performers.* Houghton Mifflin.
3. Lyons, D. (2016). Disrupted: My misadventure in the start-up bubble. Hachette UK.
4. Robbins, A., *Robbins, T., and Mallouk, P. (2017). Unshakeable: Your Financial Freedom Play- book*. Simon and Schuster.
5. Hansson, D. H., and Fried, J. (2010). *ReWork: Change the Way You Work Forever*. Random House.
6. Financial Management; *Text and Problems, 7th Ed., A Khan and P. K. Jain, Tata MacGraw Hill, ,* 44*th* ISBN: 9789353162184.
7. Kapal, R. (2018). *Kites in a Hurricane: Startups from Cradle to Fame.* Sage Publications Pvt. Limited.
8. Koontz, H., O'Donnell, C., *Weihrich, H. (1986). Essentials of management (Vol. 18).* New York: McGraw-Hill.
9. Prasanna, C. (2001). *Financial Management Theory and Practice. Tata McGraw.* Tata MacGraw Hill.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: (Rev.2023 (NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY ARTIFICIAL INTELLIGENCE | COURSE NAME | Project Implementation |
| | COURSE CODE | 2311292L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**COURSE OBJECTIVES :**

2311292L.CEO.1: To develop a sense of curiosity and critical thinking approach for implementing the solutions to the real world problems.
2311292L.CEO.2: To disseminate the project implementation techniques / methodological approaches to propose solution to the real world problems.
2311292L.CEO.3: To cognize the ethical principles, standard engineering practices in general and its importance in project implementation, documentation and ethical writing.
2311292L.CEO.4: To develop a sense of responsibility while working in a team and practice professional ethics.
2311292L.CEO.5: To disseminate the importance of Intellectual property rights, writing the research articles and publication.

**COURSE ABSTRACT**

Field project is an avenue to cater Societal and Industrial needs. Project implementation is one of the course where students will try to solve real time engineering problems. This course focuses on Selection and application of state or art technologies/ methods/engineering tools/software/analytical techniques for comparing and providing the feasible solution. Further it emphasizes on the importance of socio-economic and sustainability factors while implementing the final solution. Through this course students learn to implement the engineering fundamental concepts, get practical experience, get the chance to showcase skills, learn about team work, communication skills and responsibilities, professional behaviour. It also imparts knowledge of standard engineering practices and Intellectual Property Rights.

**Guidelines**

Preferably project team students of Sem III would be continued in this semester IV. Every project team should consist of minimum 03 and maximum of 04 students. The team members may be from different programs to support the interdisciplinary and / or multidisciplinary functioning.

1. Team members should deliberate upon different methodical approaches and finalize the appro- priate method.
2. Students project team should explore different Engineering tools/techniques for providing the problem specific solution.
3. Justify the selected method/Engineering tools/analytical techniques identified based on the fea- sibility, affordability and ease of use.
4. To implement the solution ,it is imperative to take inputs/suggestions from various stake holders.
5. Solution must be critically analyzed from various engineering and social aspects.
6. Completed solution must be pilot tested from the target user/stake holders.
7. Students need to protect their innovation,proof of concept through IPR.
8. While working in a team, individual student should contribute and communicate effectively to maintain team balance.
9. Learn and apply standard engineering practices and professional ethics.
10. Adherence to the principles of ethics, code of conduct and standard engineering practices is required.

**TIMELINE**

The THREE member jury/committee will be appointed to monitor the progress and continuous eval- uation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

Presentation of Project Review -1- Phase-I : Implementation / development of the project. 3 Weeks (1st -3rd week)

Presentation of Project Review -2 - Phase -II : Project implementation and testing.: 3 weeks (4rd- 6th week)

IPR Activity on earlier selected project problem : 2 Weeks (7th-8th week)

Preparation of Project Progress Report (week 9th and 10th)

Project Documentation ( 11th week) (Assessment by project Guide)

Submission of the final project copy to the project guide. ( 12th week)

Evaluation by external examiner ( End Semester by 13th, 14th week)

**Project Demonstration (50 Marks)**

1. **Review 1 (Project Implementation) (05 marks)**
   - Use appropriate procedures, modern tools and techniques to conduct experiments and collect data, represent in tabular/ graphical form and draw valid conclusions.
   - Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem and Verify the credibility of results.
2. **Review 2 (Project Demonstration) (10 marks)**
   - Demonstrate proficiency in using discipline specific modern tools/ techniques to solve the project problem.
   - Demonstrate an ability to describe engineering roles in a broader context, pertaining to the environment, safety, public welfare.
3. **Project Activities (05 Marks)**
   - Demonstrate an ability to prepare and publish research article.
   - Demonstrate an ability to write a Patent Draft, file IPR.
4. **Project Documentation (10 marks)**
   - Produce clear, well-constructed, and well-supported written engineering documents, project cost sheet and plagiarism report.
5. **Final project demonstration & Project team presentation (20 marks)**
   - Demonstrate effective communication,Implement the norms of standard professional prac- tices, Present results as a team showing the responsible behaviour.

**TEXT BOOKS**


Schmidt, T. (2009). Strategic Project Management Made Simple. 2nd Edition, Wiley Pub, India.ISBN 978-1-119-71817-8

Challender, J. (2022). Professional Ethics in Construction and Engineering", Wiley .ISBN-13: 978-1-119-83210-2

Rogerson, S. (2003). Computer Ethics and Professional Responsibility. 1st Edition Wiley Black- well Publication.ISBN-13: 978-1855548459

Nagarazan, R.S. (2022). A Textbook on Professional Ethics and Human Values. New Age Publication, ISBN-13: 978-81-224-2301-3

Hering, L. and Hering H. (2005). How to write Technical Reports. Springer ISBN : 978-3-540- 69929-3

Tewari, R. and Bhardwaj, M. (2021).Intellectual Property A Primer for Academia. Publication Bureau, Panjab University Chandigarh ISBN: 81-85322-92-9

**REFERENCE BOOKS**

Zwikael, O. and Smyrk, J. (2019). Project Management A Benefit Realization Approach. Springer Publication, ISBN-13: 978- 0134877693

Handley, W. (1977). Industrial Safety Handbook. 2nd Revised edition ,McGraw-Hill Companies;, ISBN-13: 978-0070844810

Mislick, G. and Mussbaum, D. (2015) Cost Estimation: Methods and Tools. Wiley, ISBN-13: 978-1-118-53613-1

Chilcutt, A. and Adam, J. (2019). Engineered to Speak: Helping You to Create and Deliver Engaging Technical Presentations. Wiley, ISBN-13: 978-1-119-47496-8

**E-CONTENTS/VIRTUAL LAB/ONLINE SIMULATOR LINKS**

University of California, free online course: https://www.classcentral.com/course/project- planning-1-12208

International Journal of Project Management : https://www.sciencedirect.com/journal/international- journal-of-project-management

Procedia- Social and Behavioral Sciences Open access journal: https://www.sciencedirect.com/journal/procedia-social-and-behavioral-sciences

Free software tool for project Management : https://onlinepmcourses.com/project-management- tools/free-project-management-resources/

Research Article:https://doi.org/10.1016/j.sbspro.2012.12.210

Research Article: https://doi.org/10.1016/j.tsc.2024.101477

Research Article: https://doi.org/10.1016/j.ijproman.2024.102584

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY ARTIFICIAL INTELLIGENCE | COURSE NAME | Internship (Life And Soft Skills) |
| | COURSE CODE | 2311296L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | NIL | 75 | 75 |

**PRE-REQUISITE :** Knowledge about the communication skills

**COURSE OBJECTIVES :**

2311296L.CEO.1: To enhance technical skills and self-directed learning.

2311296L.CEO.2: To develop adaptability and resilience in a multicultural or professional environment.

2311296L.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2311296L.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2311296L.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2311296L.CO.1: Utilize online learning platforms effectively to acquire technical skills and engage in lifelong learning [L3].

2311296L.CO.2: Apply professional behavioral practices, including teamwork, time management, and ethical decision-making, in diverse settings [L3].

2311296L.CO.3: Evaluate personal growth and adaptability gained through experiential learning and real-life experiences [L4].

2311296L.CO.4: Evaluate personal growth and adaptability gained through experiential learning and real-life experiences [L4].

2311296L.CO.5: Formulate well-defined problem statements by critically examining real-world chal- lenges and exploring innovative approaches [L4].

2311296L.CO.6: Demonstrate effective communication skills by preparing and delivering professional presentations and writing clear, concise reports [L5].

**INTRODUCTION:**

This internship is designed to equip second-year entrants B.Tech. students with essential skills for personal and professional growth. The program focuses on cultivating professionalism and life skills, enabling students to enhance their technical and soft skills in today's competitive landscape. Through this experience, students will develop a comprehensive skill set, including emotional intelligence, effective communication, teamwork, and sportsmanship. Additionally, the course encourages active participation in co-curricular and extracurricular activities, fostering resilience, adaptability, and a collaborative spirit. By completing this internship, students will establish a solid foundation for academic success and career readiness.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Life and Soft Skills is designed for students entering the second year of the B.Tech. program, to be undertaken during the summer break after Semester II. This program aims to provide opportunities for skill enhancement through life skills development, technical skills training, or industrial exposure. The internship focuses on helping students identify and engage with relevant learning platforms, small-scale industries, or training opportunities to build competencies essential for personal and professional growth. The program emphasizes cultivating life skills, such as effective communication, teamwork, emotional intelligence, and adaptability, alongside fostering technical expertise.

**Structure**

- **Duration:** : 3 to 4 weeks (minimum of 100 hours).
- **Timeframe:** Conducted during June-July of each academic year.
- **Nature of Internship:**

1. Life skills development courses.
2. Technical skills training programs.
3. Industrial training with companies or small-scale industries.

- **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.
- **Mentorship:** Each first-year student will be assigned their first-year mentor as their internship guide. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

**Internship Format and Personal Development Focus:**

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development.

**Student Development Focus :**

Before selecting an internship option, students are required to identify specific areas of self-development they wish to enhance. This may include life skills (e.g., communication, leadership, emotional intelli- gence), technical competencies, or professional abilities.

Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures reg- ular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

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**1. Continuous Assessment (CA): Biweekly Progress Reports and interaction with faculty mentor (40%):**

Students must submit at least two progress reports during the internship/training period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them
- Reports will be evaluated by the assigned first-year faculty mentor based on content quality, reflection, and consistency.

**2. Detailed Project Report with Learning Outcomes (30%)**

Upon completion of the internship, students are required to submit a comprehensive minimum of 20 to 25 pages' internship/project report. The report must include:

1. Overview of training activities
2. Skills and knowledge acquired (technical/soft/life)
3. Specific challenges addressed
4. Personal and professional growth reflections
5. Clearly stated learning outcomes
6. The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certificate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| SECOND YEAR BACHELOR O TECHNOLOGY ARTIFICIAL INTELLIGENCE | COURSE NAME | Indian Constitution |
| | COURSE CODE | 2301281A |
| | COURSE CREDITS | (Audit Course) |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 1 | NIL | NIL | NIL | NIL | NIL | NIL | NIL |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2301281A.CEO.1: To realise the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.

2301281A.CEO.2: To identify the importance of fundamental rights as well as fundamental duties.

2301281A.CEO.3: To understand the functioning of Union, State and Local Governments in Indian federal system

2301281A.CEO.4: To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2301281A.CO.1: Explain the significance of Indian Constitution as the fundamental law of the land [L2].

2301281A.CO.2: Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building [L2].

2301281A.CO.3: Analyze the Indian political system, the powers and functions of the Union, State and Local Governments in detail [L3].

2301281A.CO.4: Explain Electoral Process, Emergency provisions and Amendment procedure [L2].

**COURSE ABSTRACT**

Indian constitution is an audit course designed for the all FY. BTech students. Indian constitution is a great source of human values promoting through its legislative, executive and judiciary institutions. The key values that are learnt from constitution are justice, liberty, equality and fraternity. Constitution also teaches us to be impartial, non-partisan and tolerant in our attitude and public interactions. Liberty of thought, expression, belief or faith is necessary for all round development of an individual which the constitution teach and protects. It also inculcates the value of fraternity that promotes the spirit of common brotherhood among all citizens.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Indian Constitution** | **3 HOURS** |
| Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India, Salient features and characteristics of the Constitution of India, Scheme of the fundamental rights, The scheme of the Fundamental Duties and its legal status, The Directive Principles of State Policy – Its importance and implementation. | | |
| **UNIT 2** | **Federal Structure and Amendment** | **5 HOURS** |
| Federal structure and distribution of legislative and financial powers, between the Union and the States, Parliamentary Form of Government in India – The constitution powers and status of the President of India, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India. | | |
| **UNIT 3** | **Emergency Provisions** | **2 HOURS** |
| Emergency Provisions: National Emergency, President Rule, Financial Emergency. | | |
| **UNIT 4** | **Constitutional Schemes** | **5 HOURS** |
| Local Self Government – Constitutional Scheme in India, 13. Scheme of the Fundamental Right to Equality, Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and Personal Liberty under Article 21. | | |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | DESIGN AND ANALYSIS OF ALGORITHMS |
| | COURSE CODE | 2304314T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :**

Calculus and differential equation, Foundation of Computing

**COURSE OBJECTIVES :**

2304314T.CEO.1: To develop problem solving abilities using mathematical theories.
2304314T.CEO.2: To apply algorithmic strategies while solving problems.
2304314T.CEO.3: To analyze performance of different algorithmic strategies in terms of time.
2304314T.CEO.4: To distinguish between P and NP class of problems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304314T.CO.1: Analyze the given algorithm in terms of its computational complexity. [L4]. 2304314T.CO.2: Apply algorithmic strategies to solve given problems. [L3].
2304314T.CO.3: Find optimal solution by applying various methods. [L3].
2304314T.CO.4: Solve intractable problem by using approximation algorithm. [L3].
2304314T.CO.5: Make use of string matching algorithm to find matches between specified pattern. [L3].

**COURSE ABSTRACT:**

This course introduces the mathematical notion of algorithms and teaches how to develop, validate, and optimize them for performance and memory. The course includes a significant mathematics component, as well as the design of various algorithms.

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION OF ALGORITHMIC STRATEGY** | **08 HOURS** |
| **Applications/Case Study:** Packet switched network, Binary Search.<br>**Contents:** Algorithm, performance analysis, Need of Algorithm,Asymptotic Notation, Problem solving strategies Divide and Conquer: Basic method, Example: Quick Sort, Max-Min Problem, Large integer multiplication algorithm, Recurrence: Substitution method, Master Theorem.<br>**Self Study:** Median of Two sorted arrays of same size.<br>**Further Readings:** Strassen's Matrix Multiplication. | | |
| **UNIT 2** | **GREEDY METHOD** | **06 HOURS** |
| **Applications/Case Study:** CPU Scheduling Algorithms, Network Routing<br>**Contents:** Greedy Algorithm: Basic Method and Algorithms, Example: Fractional Knapsack Problem, Job Sequencing with Deadline, Huffman Algorithm, Activity Selection Problem.<br>**Self Study:**Coin Changing Problem<br>**Further Readings:**Task scheduling problem as a matroid. | | |
| **UNIT 3** | **DYNAMIC PROGRAMMING** | **08 HOURS** |
| **Applications/Case Study:** Google Map, Google search engine<br>**Contents:** Dynamic Programming: Basic Method, Example: 0/1 Knapsack, Chain Matrix Multipli- cation OBST, All pairs shortest path, Floyd-Warshall's Algorithm, Travelling Salesman Problem.<br>**Self Study:** Coin changing problem.<br>**Further Readings:**Longest common Subsequence Problem.Single source shortest path: Bellman Ford algorithm. | | |
| **UNIT 4** | **BACKTRACKING AND BRANCH AND BOUND** | **08 HOURS** |
| **Applications/Case Study:** Parser, Crossword puzzle, Sudoku.<br>**Contents:** Backtracking: Basic Method, Examples: Eight Queen Problem, Sum of Subset prob- lem,Branch and Bound: Basic Method, FIFO and LC approach, 0/1 knapsack problem using FIFO LC Approach, Traveling Salesperson problem FIFO LC Approach<br>**Self Study:** Backtracking Algorithms for Enumerating Independent Sets of a Graph.<br>**Further Readings:**15 Puzzle problem. | | |

| UNIT 5 | COMPUTATIONAL COMPLEXITY THEORY | 07 HOURS |
|---|---|---|
| **Applications/Case Study:** Airline crew scheduling, TSP and Graph coloring problem.<br>**Contents:** Classifying Problems, Nondeterministic Deterministic problems, Tractable Non Tractable problems, Reductions, Cook's Theorem, NP-Complete problem, NP-Hard problem,3SAT Problem Ap- proximation algorithm: vertex cover problem.<br>**Self Study:** Approximation algorithm for TSP.<br>**Further Readings:** Clique Decision problem. | | |
| **UNIT 6** | **ADVANCED ALGORITHMS AND APPLICATIONS** | **08 HOURS** |
| **Applications/Case Study:** plagiarism detector, spell checker, web search engines<br>**Contents:** Randomized algorithms : Monte Carlo and Las Vegas algorithm, String matching algo- rithm: KMP, Boyer Moore Algorithm, Robin Karp Algorithm, Number theoretic algorithm: : the GCD – Modular Arithmetic – The Chinese Remainder Theorem.<br>**Self Study:** Na¨ıve string matching algorithm.<br>**Further Readings:** The general string problem as a finite automata. | | |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | DESIGN AND ANALYSIS OF ALGORITHMS LAB |
| | COURSE CODE | 2304314L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : 01/07/2025 | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304314L.CO.1: Design algorithms using appropriate design Techniques [L3]. 2304314L.CO.2: Implement a variety of algorithms in a high level language. [L3]

2304314L.CO.3: Apply and implement learned algorithm design techniques to solve real-world prob- lems.[L3].

2304314L.CO.4: Analyze algorithms to deduce their time complexities. [L5].

**COURSE ABSTRACT:**

This course introduces the mathematical notion of algorithms and teaches how to develop, validate, and optimize them for performance and memory. The course includes a significant mathematics component, as well as the design of various algorithms.

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **Design and implement various application of divide and conquer approach.** | **4 HOURS** |
| Further practice: Strassen's Matrix Multiplication | | |
| **PRACTICAL NO.02** | **write a program to solve application using Greedy Approach. Calculate the time complexity of the algorithm.** | **4 HOURS** |
| Furthe practic NIL r e: | | |
| **PRACTICAL NO.03** | **Design and implement problem using dynamic approach.Calculate the time complexity of the algorithm.** | **6 HOURS** |
| Further practice: Coin Changing | | |
| **PRACTICAL NO.04** | **Write a program to solve application of branch and bound approach.** | **4 HOURS** |
| Further practice: Sum of Subset | | |
| **PRACTICAL NO.05** | **Design and Implement application based on backtracking approach.** | **4 HOURS** |
| Further practice: Graph coloring | | |
| **PRACTICAL NO.06** | **Design and Implement the string matching algorithm.** | **4 HOURS** |
| Further practice: Rabin Karp | | |
| **PRACTICAL NO.07** | **Design and Implement randomized algorithms.** | **4 HOURS** |
| Further practice: Quick Sort | | |

**TEXT BOOKS**


1. E.Horowitz , S. Sahni, S. Rajasekaran (2008). *Fundamentals of Computer Algorithms*. 2nd Edition, Universities Press pvt Ltd , ISBN 9788173716126.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein (2022) *Introduction to Algorithm*. 4th edition, Cambridge, Massachusetts : The MIT Press, ISBN 9780262367509.


**REFERENCE BOOKS**


1. V. Aho , J.D. Ullman (2002). *Design and Analysis of Computer Algorithms*. 1st Edition , Pearson Education 2002, ISBN 8131702057 PHI Learning Pvt Ltd, 2011, ISBN 978-81-203-40007-7.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | DEEP LEARNING |
| | COURSE CODE | 2304327T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : 01/07/2025 | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Statistics and Integral Calculus, Artificial Intelligence and Machine learning

**COURSE OBJECTIVES :**

2304327T.CEO.1: Develop a comprehensive understanding of the mathematical foundation of neural network employed on static and dynamic data set.
2304327T.CEO.2: Apply algorithms to solve real-world problems in computer vision, natural language processing, and other domains.
2304327T.CEO.3: To analyze the performance of various approaches of deep learning algorithms.
2304327T.CEO.4: Handle techniques for evaluating and fine-tuning model performance.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304327T.CO.1: Model the mathematical intuition of underlying neural networks for its application to both static and dynamic datasets[L3].
2304327T.CO.2: Apply relevant deep learning algorithms to develop intelligent systems in various real world domains[L3]
2304327T.CO.3: Evaluates the performance of intelligent models using various evaluation techniques and metrics[L5].
2304327T.CO.4: Fine-tune hyper-parameters to optimize intelligent models[L4].
2304327T.CO.5: Analyse the relative advantages and limitations of various deep learning algo- rithms[L5].

**COURSE ABSTRACT:**

This course explores deep learning in artificial intelligence, covering its fundamental principles, methodologies, and practical applications. It covers neural networks, convolutional and recurrent neural net- works, and their applications in image classification, object detection, segmentation, natural language processing, and time series analysis. The course also covers reinforcement learning and transfer learn- ing techniques. The course emphasizes both theoretical understanding and practical implementation, combining lectures with hands-on exercises and projects. Students gain a comprehensive understanding of deep learning concepts and skills in applying these techniques to real-world datasets and challenges. This equips students with the knowledge and proficiency to contribute to AI-driven solutions across various industries.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Fundamental of Neural network** | **07 HOURS** |

**Applications/Case Study:** Customer Engagement

**Contents:**Neural Network Contents: Neural Network: Introduction to Neural Networks, Fundamental Concepts: Neuron Models And Basic Learning Rules, Perceptron Training Rule, Gradient Descent And Delta Rule, Back- Propagation Algorithm,Loss Functions, Multi layer Network,Regularization techniques.

**Self Study:** Activation Function

**Further Readings:** Optimization Algorithms

| | | |
|---|---|---|
| **UNIT 2** | **Deep Convolutional Neural network** | **08 HOURS** |

**Applications/Case Study:** Chest X Ray Image Classification

**Contents:**Convolutional Neural Network (CNN)Architecture, Activation Functions, Training and Back-propagation Transfer Learning:Approaches,Pre-trained Models,Fine-tuning and Feature Extrac- tion. Object Detection: Faster R-CNNs, YoLO,evaluation metrics.

**Self Study:**RetinaNet

**Further Readings:**Graph Convolutional Neural Networks

| | | |
|---|---|---|
| **UNIT 3** | **Deep Quantum Computing** | **08 HOURS** |

**Applications/Case Study:** Quantum-enhanced image classification

**Contents:** Quantum Mechanics Foundations,Quantum Gates and Circuits,Quantum Algorithms,Overview of Quantum CNN,Architecture of Quantum CNN, Quantum CNN Operations simu- lators -IBM's Qiskit, PennyLane, or Google's Cirq.

**Self Study:** Quantum Error Correction

**Further Readings:**Quantum Hardware

| UNIT 4 | Time Series Analysis | 08 HOURS |
|---|---|---|
| **Applications/Case Study:** Marketing and Customer Analytics<br>**Contents:** Time Series Data,Time Series Decomposition Statistical Models:Autoregressive Inte- grated Moving Average (ARIMA), Forecasting Techniques, Sequence Model,Understanding sequential data,Types of sequence models,Hidden Morkow Model,Recurrent Neural Network,Vanishing gradient Problem,Long Short term Memory,Gated Recurrent Unit,mathematical modeling of behind sequence model.<br>**Self Study:** Seasonal Decomposition of Time Series (STL)<br>**Further Readings:**Stochastic recurrent neural network | | |
| **UNIT 5** | **Sequence to Sequence Models** | **08 HOURS** |
| **Applications/Case Study:** Text Summarization and Machine Translation<br>**Contents:**Overview of Natural language processing, Introduction to Seq2Seq models,Encoder-Decoder Architecture,Attention Mechanism, Transformer-based Seq2Seq Models: Introduction of transformer architecture and self-attention mechanisms for parallelized computation,Handling Variable-Length Se- quences,Evaluation Metrics: BLEU for machine translation and ROUGE for summarization.<br>**Self Study:** Teacher Forcing,Beam Search<br>**Further Readings:** Fine-tuning encoder and decoder | | |
| **UNIT 6** | **Explainable AI** | **06 HOURS** |
| **Applications/Case Study:** Interpreting Diabetes Risk Predictions.<br>**Contents:** Introduction to Explainable AI,Model-Specific, Model-Agnostic:LIME (Local Interpretable Model-agnostic Explanations): Approximating models with simple interpretable ones. SHAP (SHapley Additive exPlanations).<br>**Self Study:**Trends in research (causality in XAI, human-centered AI). The role of XAI in AI governance and regulation.<br>**Further Readings:** Ethical considerations: Bias, fairness, and regulatory compliance (GDPR, etc.) | | |

**TEXT BOOKS**

Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016). *Deep Learning*. 1st Edition, The MIT Press . ISBN 978-0262035613.

Aur´elien G´eron(2019) *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition*. 1st Edition,Packt Publishing. ISBN 9781492032649.

**REFERENCE BOOKS**

Maxim Lapan.(2018).*Deep Reinforcement Learning Hands-Ons*Packt Publishing. ISBN 978-1788834247

Seth Weidman.(2019).*Deep Reinforcement Learning Hands-Ons*Packt Publishing. ISBN 978-1788834247

**E-BOOKS/E-CONTENTS LINKS**

Dive into Deep Learning:Aston Zhang, Zachary C. Lipton, Mu Li, And Alexander J.Smola. (2024). *Dive into Deep Learning* Paperback. ISBN 1009389432. link- https://d2l.ai/d2l-en.pdf

https://developer.nvidia.com/deep-learning

https://builtin.com/machine-learning/deep-learning

https://www.deeplearningbook.org/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | DEEP LEARNING LAB |
| | COURSE CODE | 2304327L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : 01/07/2025 | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Statistics and Integral Calculus, Artificial Intelligence and Machine learning

**COURSE OBJECTIVES :**

2304327L.CEO.1: Develop hands-on skills to implement and train deep learning models using popular frameworks.

2304327L.CEO.2: Identify problems that can be effectively addressed using deep learning solutions.

2304327L.CEO.3: Evaluate the performance of deep learning models using evaluation metrics.

2304327L.CEO.4: Assess the strengths and limitations of different deep learning approaches.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304327L.CO.1: Develop critical thinking skills by solving real-world problems using deep learning algorithm.[L4]

2304327L.CO.2: Investigate strategies for improved model generalization, reducing overfitting, enhanc- ing unseen performance.[L4]

2304327L.CO.3: Optimize models by fine-tuning hyperparameters for task-specific and dataset-specific optimal performance.[L5]

2304327L.CO.4: Discuss results to draw conclusions on problem-solving method effectiveness.[L5]

2304327L.CO.5: Improve collaboration through group discussions, sharing insights, and contributing to DL projects in lab settings. [L5]

**COURSE ABSTRACT:**

This course explores deep learning in artificial intelligence, covering its principles, methodologies, and practical applications. Students will learn about neural networks, convolutional neural networks, and recurrent neural networks, and their roles in tasks like image classification, object detection, segmentation, natural language processing, and time series analysis. The course combines theoretical understanding with practical implementation through lectures, exercises, and projects. Lab components include hands- on exercises, project-based assignments, experimentation with pre-trained models, and integration with web applications. Students will gain a comprehensive understanding of deep learning principles and methodologies.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Neural Networks design and deployment** | **4 HOURS** |

1. Model Development: Design and train the neural network with appropriate architecture, loss function, optimizer, and data handling techniques, ensuring model accuracy and performance through evaluation and hyperparameter tuning.

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Transfer Learning** | **6 HOURS** |

1. Transfer Learning Model Development: Fine-tune a pre-trained model on your specific dataset, adjusting the top layers and optimizing hyperparameters to achieve desired performance metrics.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Object Detection and Multi object classification** | **4 HOURS** |

1. Dataset Preparation and Model Design: Select and preprocess a dataset with annotations for object detection, segmentation masks, and class labels. Design a deep learning architecture that integrates object detection, segmentation, and recognition tasks.
2. Model Training and Optimization: Train the multi-task model, experiment with hyperparameters, and fine-tune using transfer learning. Implement optimization techniques to enhance performance.
3. Evaluation and Visualization: Evaluate the model on a test dataset, create visualizations of predictions, and discuss challenges and potential real-world applications.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Natural Language Processing** | **4 HOURS** |

1. Data Preparation: Obtain a dataset with sentiment labels, clean the data using NLP tools, and visualize sentiment distribution.
2. Text Representation and Model Training: Convert text to numerical vectors using TF-IDF or word embeddings, implement a baseline model, and split the dataset into training and testing sets.
3. Evaluation and Conclusion: Evaluate models on the test set using relevant metrics, summarize key findings, suggest improvements, and recommend future research directions.

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **Sequence Classification** | **4 HOURS** |

1. Development: Design and train a deep sequence model (e.g., RNN, LSTM, GRU, Transformer) using a suitable dataset for sequence classification tasks, ensuring to preprocess the data appro- priately and tune hyperparameters for optimal performance.
2. Evaluation: Validate the model's performance on a separate test set, using metrics like accuracy,
   precision, recall, and F1-score to assess its effectiveness in classifying sequences accurately.

| PRACTICAL NO.06 | Sequence Generation | 6 HOURS |
|---|---|---|

1. Model Design and Training: Construct and train a deep sequential model (e.g., LSTM, GRU, Transformer) on a dataset of sequences, focusing on generating new sequences by learning patterns from the input data.
2. Evaluation and Fine-tuning: Assess the model's ability to generate coherent and relevant se- quences by comparing generated sequences against a validation set, and fine-tune the model's parameters to improve generation quality.

| PRACTICAL NO.06 | Mini Project (Object detection/NLP). | 6 HOURS |
|---|---|---|

1. The mini project aims to create a real-time object detection/langauge based web application that uses a pre-trained deep learning model to identify objects in a live webcam feed or dynamic data.
2. The project involves selecting a suitable dataset and model, pre-processing the data, integrating the model, developing the web application, deploying it, and documenting the project.
3. The project will take five weeks, with a maximum of three students participating. The team will prepare a project plan, select a real-time dataset, and select a pre-trained model.
4. The project will also involve data pre-processing, model integration, web application development, deployment, and documentation.
5. Regular communication and collaboration will be maintained throughout the project, with the goal of having a fully functional real-time object detection or NLP web application ready for deployment.

**TEXT BOOKS**

Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016). *Deep Learning*. 1st Edition, The MIT Press . ISBN 978-0262035613.

Rajalingappaa Shanmugamani(2018) *Deep Learning for Computer Vision*. 1st Edition,Packt Pub- lishing. ISBN 978-1788295628.

Aur´elien G´eron(2019) *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*. 1st Edition O'Reilly Media. ISBN 978-149203264

**REFERENCE BOOKS**

A. B. A. Arriola, J. R. G. de C. Santos, and J. A. de Morais Amado.(2021). *Quantum Neural Networks*,Springer Publishing. ISBN: 978-3030641911

Seth Weidman.(2019).*Deep Reinforcement Learning Hands-Ons*Packt Publishing. ISBN 978-1788834247

Parikshit N. Mahalle and Poonam N.(2021) *Explainable AI: Foundations, Applications, and Chal- lenges*. Wiley-Scrivener Publishing. ISBN-13: 978-1119786202

**E-RESOURCES**

Dive into Deep Learning:Aston Zhang, Zachary C. Lipton, Mu Li, And Alexander J.Smola.(2024). *Dive into Deep Learning*Paperback. ISBN 1009389432. link- https://d2l.ai/d2l-en.pdf

https://developer.nvidia.com/deep-learning

https://builtin.com/machine-learning/deep-learning

https://www.deeplearningbook.org/

https://www.ibm.com/topics/explainable-ai

https://research.ibm.com/topics/quantum-machine-learning

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | CLOUD COMPUTING FOUNDATIONS |
| | COURSE CODE | 2304323T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**COURSE OBJECTIVES :**

2304323T.CEO.1: To introduce various cloud computing services and models

2304323T.CEO.2: Enable students to strategize the selection of optimal configurations for compute nodes

2304323T.CEO.3: To configure appropriate storage service for the specific application requirement

2304323T.CEO.4: To implement networking and security settings in cloud environment 2304323T.CEO.5: To create the application using high scalability and reliability considerations

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304323T.CO.1: Categorize different types of cloud computing services and models [L3]. 2304323T.CO.2: Choose appropriate compute service configuration within a cloud environment [L3]. 2304323T.CO.3: Distinguish between storage-related services utilized in application development[L3]. 2304323T.CO.4: Choose the suitable database service for a given application scenario [L3].

2304323T.CO.5: Evaluate various networking and security [L5]. configurations based on specific problem-solving requirements [L3].

2304323T.CO.6: To examine different networking and security choices while developing an application [L3].

**COURSE ABSTRACT:**

Cloud Computing Foundations is one of the fundamental course to implement various Service Models and Deployment Models to be used to solve real world problems. Cloud Computing Foundations Lab assignments are designed for both Service Models and Deployment Models concepts. This course im- plements various operations of collecting, organizing and storing of data in an efficient way in order to solve real time problems. Learners cultivate broad and in depth knowledge of synthesizing and analyzing Service Models using appropriate compute, storage and network services in order to provide solutions to real world problems. The objective of the course is to identify global infrastructure components of AWS, understand and demsotrate AWS EC2,Load Balancing,EBS, EFS,S3,Auto Scaling.

**THEORY COURSE CONTENT**

| UNIT 1 | Introduction to Cloud Computing | 8 HOURS |
|---|---|---|

**App/System/Case study:** Amazon AWS, Microsoft Azure, Salesforce

**Contents:** Recent trends in Computing - Grid Computing, Cluster Computing, Utility Computing, Cloud Computing. Evolution of cloud computing - Business driver for adopting cloud computing Distinguishing Cloud Types, Deployment Models, Service Models, Scalability, Virtualization, Software as a service (SaaS): understanding multitenant nature, service oriented architecture, Platform as a service (PaaS): Benefits and disadvantages, Infrastructure as a service (IaaS)

Web as a portal to cloud : Overview of web protocols like HTTP, SOAP, REST and XML.

Virtualization : types, hypervisors.

Cloud economics and billing

**Self study:** Hybrid cloud service providers

**Further Reading:** REST implementation

| UNIT 2 | Networking and Security Services in Cloud Computing | 9 HOURS |
|---|---|---|

**App/System/Case study:** Amazon VPC, Amazon Route S3, Amazon Elastic Load Balancing, Ama- zon Cloud Front

**Contents:** Building cloud network(VPC) : defining and provisioning isolated networks, gateways in cloud, providing private connectivity in hybrid cloud environments Scaling cloud network : automatic traffic distribution across pool of servers, direct traffic routing for achieving performance Securing net- work traffic : Configuring and managing firewall rules, access permission,Security Groups and NACLs Identity and Access Management in Cloud Network: Users, Groups, Roles, Permission Policies, Per- mission Boundary, Service Control Policies

**Self study:** Advanced Firewall Settings

**Further Reading:** VPN Connectivity in AWS

| UNIT 3 | Compute Services in Cloud Computing | 7 HOURS |
|---|---|---|
| **App/System/Case study:** Amazon EC2, Virtualbox, Docker<br>**Contents:** Compute node architecture, parameters to consider while configuring compute node, Ma- chine images, instances, instance types, tags, key pairs, security groups, regions and zones – types User data and metadata for instance, instance tenancy<br>**Self study:** Kubernetes<br>**Further Reading:** Virtual Machine Internal XML file | | |
| **UNIT 4** | **Storage Services in Cloud Computing** | **6 HOURS** |
| **App/System/Case study:** Amazon S3, Amazon EBS, Amazon EFS, Amazon Glacier<br>**Contents:** Examining the Evolution of Network Storage, Understanding Cloud-Based Data Storage, Advantages and Disadvantages of Cloud-Based Data Storage. Cloud- Based Backup Systems<br>Types of cloud storage – File Storage - EFS, Block Storage – Elastic Block Storage, Object Based Storage – S3<br>**Self Study:** Google File System<br>**Further Reading:** CEPH File System | | |
| **UNIT 5** | **Database Services in Cloud Computing** | **8 HOURS** |
| **App/System/Case study:** Amazon RDS, Amazon DynamoDB, Amazon ElastiCache, Amazon Nep- tune<br>**Contents:** Need for cloud databases, considerations for cloud databases, architecture and common characteristics, Data Models<br>Relational database, Key – value based database, In-memory database, Document based database, Graph based database, Time series database, Ledger based database.<br>High availability and load balancing in databases<br>**Self Study:** Real time graph databases<br>**Further Reading:** Blockchain | | |
| **UNIT 6** | **High Availability and Scalability Services in Cloud Computing** | **7 HOURS** |
| **App/System/Case study:** Amazon EC2, Amazon EBS, AWS Autoscaling<br>**Contents:** Definition, elements of high availability. High availability for compute resources, high avail- ability for databases and high availability for storage services.<br>Elastic Load Balancing – Types of load balancers, Target Groups, Health monitoring autoscaling Groups: Scaling policies, Launch templates, Min, Max and Desired counts .<br>Scalability issues, vertical scaling vs. horizontal scaling vs. diagonal scaling, difference between scala- bility and elasticity<br>**Self Study:** Autoscalling algorithms<br>**Further Reading:** Highly available and salable file system features | | |

**E-RESOURCES**

https://docs.aws.amazon.com/
https://www.workshops.aws/
https://www.terraform.io/
https://boto3.amazonaws.com/v1/documentation/api/latest/index.html

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | CLOUD COMPUTING FOUNDATIONS LAB |
| | COURSE CODE | 2304323L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304323L.CO.1: Categorize different types of cloud computing services and models [L3]. 2304323L.CO.2: Choose appropriate compute service configuration within a cloud environment [L3]. 2304323L.CO.3: Distinguish between storage-related services utilized in application development [L3]. 2304323L.CO.4: Choose the suitable database service for a given application scenario [L3].
2304323L.CO.5: Evaluate various networking and security [L3]. configurations based on specific problem-solving requirements [L5].
2304323L.CO.6: To examine different networking and security choices while developing an application [L4].

| PRACTICAL: | | |
|---|---|---|
| **PRACTICAL NO.01** | **First Virtual Machine on AWS** | **4 HOURS** |
| Launching the virtual machine on Amazon AWS and doing basic settings | | |
| **PRACTICAL NO.02** | **Storage Configuration** | **4 HOURS** |
| Configuring various storages available on AWS and storing, retrieving, deleting the data from those<br>storage applications | | |
| **PRACTICAL NO.03** | **Database Configuration** | **4 HOURS** |
| Configuring and using various databases available on Amzon AWS | | |
| **PRACTICAL NO.04** | **Networking and Security Services Configuration** | **6 HOURS** |
| Configuring various networking and security options | | |
| **PRACTICAL NO.05** | **High availability and scalability services** | **4 HOURS** |
| Configuration of high availability and scalability services | | |
| **PRACTICAL NO.06** | **Project** | **6 HOURS** |
| Implement a project based on all the services studied for a given application on Amazon AWS | | |

**TEXT BOOK**


Wittig, Michael, Andreas Wittig and Ben Whaley (2023). *Amazon web services in action*. 3rd Edition,Manning, ISBN 9781633439160.

Murty, James, Andreas Wittig and Ben Whaley (2008). *Programming amazon web services: S3, EC2, SQS, FPS, and SimpleDB*. O'Reilly Media, Inc., ISBN 9780596515812.

David Clinton and Ben Piper (2021). *AWS Certified Solutions Architect Study Guide - Associate SAA-C02 Exam*. 3rd Edition,Sybex, ISBN 1119713080.

Albert Anthony (2017). *Mastering AWS Security,: Create and maintain a secure cloud ecosystem*, Packt Publishing Limited, ISBN 9781788293723.

van Vliet, Jurg, Flavia Paganelli, and Jasper Geurtsen (2013). *Resilience and Reliability on AWS*. 1st Edition,O'Reilly Media, ISBN 9789351100010.

Sarkar, Aurobindo, and Amit Shah (2018). *Learning AWS: Design, build, and deploy respon- sive applications using AWS Cloud components*. 2nd Edition,Packt Publishing Limited, ISBN

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | CRYPTOGRAPHY AND INFORMATION SECURITY |
| | COURSE CODE | 2304324T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE :** Requires knowledge of Computer Networks, calculus, and basic linear algebra

**COURSE OBJECTIVES :**

2304324T.CEO.1: To prepare Cryptography theories, algorithms, and systems.

2304324T.CEO.2: To Explain necessary Approaches and Techniques to build protection mechanisms to secure information.

2304324T.CEO.3: To understand the basic categories of threats to computers and their information.

2304324T.CEO.4: To approach the fundamental ideas of public-key cryptography and symmetric key cryptography.

2304324T.CEO.5: Critically discuss IP Security, Web security, and Firewalls.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304324T.CO.1: Examine the security threats and the security mechanisms to counter them. [L3]

2304324T.CO.2: Apply security principles to protect the data.[L3].

2304324T.CO.3: Demonstrate common symmetric and asymmetric encryption algorithms used as stan- dards in modern cryptosystems [L3].

2304324T.CO.4: Compare the properties of hash algorithms in digital signature. [L4]

2304324T.CO.5: Analyze information security policies.[L5]

2304324T.CO.6: Inspection network security threats and provide solutions to protect the network.[L5]

**COURSE ABSTRACT:**

This course will deal with the construction and analysis of different security techniques that prevent third parties from reading private data between two parties. Cryptography has evolved to address the encryption and decryption of user data through the internet and computer systems. It is a branch of cyber and network security.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION OF SECURITY IN COMPUTING ENVI- RONMENT** | **07 HOURS** |

**Applications/Case Study:**Threats, Vulnerabilities, and Controls.

**Contents:** Introduction to the concepts of Security, Need for Security; Security Attacks, Types of Attacks, Classical and Modern Cryptography; Security Services and Mechanisms. Substitution Tech- niques, Transposition Techniques, Chinese Remainder theorem, and Cryptography techniques.

**Self Study:** : Prime numbers

**Further Readings:** stenography Foundations of modern cryptography.

| | | |
|---|---|---|
| **UNIT 2** | **SYMMETRIC KEY CRYPTOGRAPHY** | **08 HOURS** |

**Applications/Case Study:** Properties of Trustworthy Encryption Systems.

**Contents:** Modular Arithmetic, Euclidean and Extended Euclidean algorithm,Data Encryption Stan- dard (DES) Algorithm – Overview of the DES Algorithm; Triple DES; Security of the DES; Ad- vanced Encryption Standard (AES), International Data Encryption Standard (IDEA), Cloud Encryp- tion, Blowfish, RC4.

**Self Study:** Cloud Security Risk and Counter Measures

**Further Readings:**RC5

| | | |
|---|---|---|
| **UNIT 3** | **PUBLIC KEY ENCRYPTION** | **08 HOURS** |

**Applications/Case Study:** Case study on Public key cryptography.

**Contents:** An introduction to asymmetric key encryption, Characteristics of Public Key System; RSA Technique, Encryption Fill Algorithm, Boundary Fill Method; Key Exchange; Diffie Hellman Key exchange, Elliptic Curve Cryptography, Quantum Cryptography.

**Self Study:** Post-Quantum Cryptography.

**Further Readings:**Elgamal cryptography.

| | | |
|---|---|---|
| **UNIT 4** | **HASH FUNCTIONS AND DIGITAL SIGNATURE** | **07 HOURS** |

**Applications/Case Study:** Demonstration Digital Certificate Creation.

**Contents:** Hash functions: Authentication requirement, MAC, HMAC, Hash algorithms: Message digest algorithms, SHA algorithms, Digital signature, DSS(Digital Signature Standard). Public key cryptographic standards (PKCS).

**Self Study:** The PKIX model.

**Further Readings:**Implementation of Digital Certificate

| UNIT 5 | EMAIL AND WEB SECURITY | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Case study on security policy

**Contents:** Email Security: SMTP, Mail message formats, Mail access protocols, Pretty good pri- vacy(PGP), Operational description of PGP, S/MIME, S/MIME functionality. Web Security: Se- cure Socket Layer(SSL architecture, Transport Layer Security 1.2(TLS), Secure Electronic Transac- tion(SET), SET components, SET transaction, JWT (JSON Web Token) Authentication.

**Self Study:** Overview of HTTPS.

**Further Readings:** Cryptographic keys and key rings.

| UNIT 6 | IP SECURITY PRACTICE AND SYSTEM SECURITY | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Demonstration of IP Security and firewall.

**Contents:** IP Security Overview: IPSec architecture, IPSec services, IPSec Applications and benefits, VPN, What is system security, Types of layers and attacks on each layer, Different types of Firewalls, Intrusion Detection.

**Self Study:** DDOS attack

**Further Readings:** Firewall configuration.

**TEXT BOOKS**

Atul Kahate, *"Cryptography and Network Security",*. 7th The McGraw Hill Publication Third Edition, ISBN – 13: 978-0-07-064823-4.

Eric Maiwald, *"Network Security: A Beginners' Guide" ,*.7th ISBN: 978-007-179571-5.

**REFERENCE BOOKS**

William Stallings, *"Cryptography and Network Security",* . 13th Seventh Edition ISBN-10:1-292-15858-1

Behrouz A. Forouzan, *"Introduction to Cryptography and Network Security",* . 13th McGraw-Hill Forouzan Networking Series, ISBN 978–0–07–287022–0.

**E-RESOURCES**

https://www.cs.vsb.cz/ochodkova/courses/kpb/cryptography-and-network-security *principles − and − practice − 7th − global − edition.pdf*

*https* : *//nptel.ac.in/courses/*106105031

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | CRYPTOGRAPHY AND INFORMATION SECURITY LAB |
| | COURSE CODE | 2304324L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Number Theory, Computer Networks.

**COURSE OBJECTIVES :**

2304324L.CEO.1: To identify basic security attacks and services and the importance of number theory 2304324L.CEO.2: To understand symmetric and asymmetric key algorithms for cryptography 2304324L.CEO.3: To design a security solution for a given application

2304324L.CEO.4: To analyze key management techniques

2304324L.CEO.5: To understand authentication functions and how message authentication codes and hash functions work FOR Firewalls.

**COURSE OUTCOMES :**

After successful completion of the course, students Shall be able to,

2304324L.CO.1: Implement cryptography, the CIA triad of information security types.[L3]. 2304324L.CO.2: Apply the various encryption mechanisms for secure transmission of data and key management required for encryption.[L3].

2304324L.CO.3: Build digital signature schemes and message authentication techniques.[L3]

**COURSE ABSTRACT:**

This course will deal with the construction and analysis of different security techniques that would prevent any third parties from reading private data between two parties. cryptography has evolved to address the encryption and decryption of user data through the internet and computer systems, It is a branch of cyber and network security

| **PRACTICALS** | | |
|---|---|---|
| PRACTICAL NO.01 | Write a program to encrypt and decrypt the message using encryption decryption techniques 1. Substitute Method 2. Transposition Method | **4 HOURS** |
| | | |
| PRACTICAL NO.02 | Develop a program in C++/Java/Python on Ad- vanced Extended Euclidean Algorithm. | **4 HOURS** |
| | | |
| PRACTICAL NO.03 | Write a program to implement one of Symmetric Key Cryptography (AES, /DES/ RC4 etc.). | **4 HOURS** |
| | | |
| PRACTICAL NO.04 | Write a program to implement public key cryptogra- phy algorithm RSA. | **4 HOURS** |
| | | |
| PRACTICAL NO.05 | Implement Diffie Hellman key exchange algorithm in client server architecture. | **4 HOURS** |
| | | |
| PRACTICAL NO.06 | Calculate the message digest of a text using the SHA-1 or MD5 algorithm in JAVA/Python/C++. | **4 HOURS** |
| | | |
| PRACTICAL NO.07 | Create your own digital certificate using java key tool | **2 HOURS** |
| | | |
| PRACTICAL NO.08 | Develop a program in .NET,/Python to encode and decode the message for Authentication using HMAC SHA256 | **4 HOURS** |
| | | |

**TEXT BOOKS**

Eric Maiwald (2021). *Network Security: A Beginners' Guide*. 13th Edition, ISBN: 978-0-07-179571-5.

Atul Kahate (2008),. *Cryptography and Network Security, Tata Mc Grawhill, India.*. 2th Edition, ISBN: 978-0-07-064823-4.

**REFERENCE BOOKS**

William Stallings . *Cryptography and Network Security Prentice Hall, Seventh* . 7th Edition, ISBN-10:1-292-15858-1 .

Matt Bishop, . *Computer Security Prentice Hall, Seventh* . 1th Edition, Addison-Wesley, 2004

**E-RESOURCES**

1. IIT Delhi, Virtual lab on Cryptography- https://cse29-iiith.vlabs.ac.in/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | LINUX ADMINISTRATION-I |
| | COURSE CODE | 2304361L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Fundamental of Linux operating system, Operating system

**COURSE OBJECTIVES :**

2304361L.CEO.1: To configuring, installing, and upgrading Linux systems using established standards and procedures.

2304361L.CEO.2: To understand Redhat Linux operational support. 2304361L.CEO.3: To monitor system performance and availability.

2304361L.CEO.4: Gain sufficient skill to perform core system administration tasks on Red Hat Enter- prise Linux

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304361L.CO.1: Utilize essential Linux administration tasks [L3]. 2304361L.CO.2: Experiment with installation,networking and user profiles. [L3]. 2304361L.CO.3: Examine physical storage, file systems and log files [L3].

2304361L.CO.4: Inspect the Linux processes,control services,daemons and basic security administra- tion.[L4].

2304361L.CO.5: Analyze Redhat Linux System with a comprehensive and systematic approach [L4].

**COURSE ABSTRACT:**

Red Hat System Administration I. The course provides students with Linux administration ”survival skills” by focusing on core administration tasks. Red Hat System Administration I also provides a foundation for students who plan to become full-time Linux system administrators by introducing key command-line concepts and enterprise-level tools. and also to build foundational skills that an RHCSA- certified Red Hat Enterprise Linux system administrator needs.

| **PRACTICALS** | | |
|---|---|---|
| PRACTICAL NO.01 | Introduction to Linux. | **4 HOURS** |
| PRACTICAL NO.02 | Accessing the Command Line: Accessing the Command Line,Accessing the Command Line Using the Desktop,Executing Commands Using the Bash Shell | **4 HOURS** |
| PRACTICAL NO.03 | Managing Files From the Command Line | **4 HOURS** |
| PRACTICAL NO.04 | Getting Help in Red Hat Enterprise Linux. | **4 HOURS** |
| PRACTICAL NO.05 | Create, view, and edit text files from command output or in an vim editor Files | **4 HOURS** |
| PRACTICAL NO.06 | Manage local Linux users and groups: Manage local Linux users and groups, and administer local password policies. | **4 HOURS** |
| PRACTICAL NO.07 | Control access to files with Linux file system permissions: Set Linux file system permissions on files and interpret the security effects of different permission settings. | **4 HOURS** |
| PRACTICAL NO.08 | Monitor and manage Linux processes: Obtain information about the system, and control processes running on it | **4 HOURS** |
| PRACTICAL NO.09 | Control services and daemons: Control and monitor network services and system daemons using Systemd | **4 HOURS** |
| PRACTICAL NO.10 | Configure and secure OpenSSH service: Access and provide access to the command line on remote systems securely using OpenSSH | **4 HOURS** |
| PRACTICAL NO.11 | Analyse and store logs: Locate and accurately interpret relevant system log files for troubleshooting purposes. | **4 HOURS** |
| PRACTICAL NO.12 | Manage Red Hat Enterprise Linux networking: Configure basic IPv4 networking on Red Hat Enterprise Linux systems | **4 HOURS** |

| | | |
|---|---|---|
| PRACTICAL NO.13 | Archive and copy files between systems: Archive files and copy them from one system to another. Install and update software packages: Download, install, update, and manage software packages from Red Hat and yum package repositories | **4 HOURS** |
| PRACTICAL NO.14 | Access Linux file systems: Access and inspect existing file systems on a Red Hat Enterprise Linux sys- tem | **4 HOURS** |
| PRACTICAL NO.15 | Analyze Servers and Get Support:Analyze and Manage Remote Servers,Create a Diagnostics Report, Detect and Resolve Issues with Red Hat Insights | **4 HOURS** |

**TEXT BOOKS**

1. Red Hat Enterprise Linux 9.0, ”RH124: RED HAT SYSTEM ADMINISTRATION I”, Student Guide

**REFERENCE BOOKS**

1. Red Hat Enterprise Linux 8.0, ”RH124: RED HAT SYSTEM ADMINISTRATION I”, Student Guide

**E-RESOURCES**

1. https://rha.ole.redhat.com/rha/app/courses/rh124

| TECHNOLOGY | COURSE CODE | 2304362L |
|---|---|---|
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304362L.CO.1: Construct websites using fundamental web languages, technologies and tools [L3].

2304362L.CO.2: To Develop a front-end web application using ReactJS [L3].

2304362L.CO.3: To Construct and configure a backend server using NodeJS and ExpressJS framework [L3].

2304362L.CO.4: To Design a RESTful API for the front-end to access backend services. [L3].

**COURSE ABSTRACT:**

Web Development course syllabus aims to teach about front-end, back-end, and full-stack Web Development. Web Development course covers various topics under Web Development such as Database Management, Web Publishing, Web Design, and Web Programming. Some of the important topics covered in this course include Web Overview and Introduction to Web Development Tools, HyperText Markup Language and Cascading Style Sheets, Introduction to JavaScript, JS Functions and Objects, JavaScript and the DOM, ExpressJs, ReactJs, NodeJs, Moongodb etc. Full stack development using MERN technology.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **HTML, CSS and Frameworks (Bootstrap)** | **10 HOURS** |
| Pre Work: Installation and Configuration of Web Application Servers- Tomcat.<br>1. Design and develop any suitable single page web application using HTML/DHTML, CSS/CSS3 and Framework.<br>• Responsive website design with respect to layouts<br>NOTE : Each student has to create a webpage Example : Amazon.co.in front page etc. | | |
| **PRACTICAL NO.02** | **Javacript** | **10 HOURS** |
| 2. Design and develop any suitable web application to demonstrate the capabilities of Javacript.<br>• Use JSON and Array for storing the data, before saving the data, validate it and show proper error messages.<br>Note : Students have to build web pages for Interactive type applications. Example Calculator, Chat windows etc. | | |
| **PRACTICAL NO.03** | **Front-End JavaScript Frameworks: ReactJS** | **8 HOURS** |
| 3. Design, develop and deploy an web application to demonstrate the client side validation using REACTJS. Note : Students have to do Client-side validation / Interactive type applications. | | |
| **PRACTICAL NO.04** | **Server-side Development: NodeJS** | **8 HOURS** |
| 4. Design, develop and deploy an web application to demonstrate the server side validation using NodeJS.<br>Note : Student will Demonstrate all the capabilities of NodeJS. | | |
| **PRACTICAL NO.05** | **Web Application Framework: ExpressJS** | **6 HOURS** |
| 5. Design, develop and deploy an web application to demonstrate the server side validation using ExpressJS.<br>Note : Student will demonstrate all the capabilities of ExpressJS. | | |

| | | |
|---|---|---|
| **PRACTICAL NO.06** | **RESTful API** | **8 HOURS** |

| | | |
|---|---|---|
| 6. Create an API to perform CRUD operation in the database and deploy the application on any web hosting provider and test the API using Postman.<br>Note : Student will demonstrate the building and deploying of API's. | | |
| **PRACTICAL NO. 7** | **NoSQL Database (MongoDB)** | **10 HOURS** |
| 7. Design, develop and deploy an web application to interact with NoSQL database from a Node application.<br>Note : Student will demonstrate the working the NoSQL<br>Self-study Component : Fundamentals of DynamoDB, Fundamentals of Apache Cassandra | | |

**TEXT BOOKS**


Ralph Moseley, M.T. Savaliya. *Developing Web Applications.* Willy India,2th Edition, ISBN 9788126538676.

Chris Minnick,. *Beginning React JS Foundations Building User Interfaces with ReactJS: An Approachable Guide.* Willy India,1st Edition 2023, ISBN 9781119685630.


| | | |
|---|---|---|
| MIT \| Academy of Engineering<br>(An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
| **DEPARTMENT OF ARTIFICIAL INTELLIGENCE** | **W.E.F** | **AY:** |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Mobile Application Developement |
| | **COURSE CODE** | 2304363L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**COURSE OBJECTIVES :**

2304363L.CEO.1: To apply Java programming concepts to Android app development.
2304363L.CEO.2: To design and develop application for the Android platform 2304363L.CEO.3: To understand mobile application development using Android Studio

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304363L.CO.1: Install and configure Android application development tools [L3]. 2304363L.CO.2: Design and develop User Interfaces for the Android platform [L3].
2304363L.CO.3: Apply SQLite database techniques to store information in persistence storage [L3].
2304363L.CO.4: Construct various Layouts and Widgets in Android Applications [L3].
2304363L.CO.5: Develop and publish mobile app.[L3]

**COURSE ABSTRACT:**

This course is designed to provide with practical hands-on experience in creating, designing, and implementing android applications. Throughout this lab, students will be able to Learn Android Fundamen- tals, Mastering User Interface Design, Implement Functionality, Utilize APIs and Libraries, Testing and Debugging, Publishing and Distribution. The exciting world of mobile app development that specifi- cally focuses on the Android platform. This lab is structured to equip with the fundamental skills and knowledge required to develop Android applications effectively. This course will provide a solid foun- dation in the development of Android applications, as Android being one of the most popular mobile operating systems worldwide, offers vast opportunities for developers to create innovative and impactful applications that can reach millions of users globally.

GUIDELINES FOR CONDUCTION OF LAB

Course Teacher or Lab Instructor may frame the assignments/mini-project by understanding the prerequisites, technological aspects, utility and recent trends related to the respective courses.

According to assigned number of hours, course instructor has to decide minimum number of practical assignments.

**3:** Preferably there should be multiple sets of assignments/mini-project and distribute among batches of students.

**4:** Mini-project can be completed in group of 2 to 3 students

CONTENTS

Basic building blocks of Android with example
Android Layouts and UI composition
Database SQLite, Shared Preferences and Files
Notifications
Location Service and Maps
Creating distributable APK and Publishing

| PRACTICAL | | |
|---|---|---|
| **PRACTICAL NO.01** | **Installation of Android Studio and Introduction of Android** | **4 HOURS** |
| a. Installing all required software's for android development and emulator | | |
| **PRACTICAL NO.02** | **Basic building blocks of Android with example** | **6 HOURS** |
| a. Understanding all basic building blocks of Android [activities, views, intents, etc.<br>b. Assignment based on Activity and Intents<br>c. Assignment based on android service | | |
| **PRACTICAL NO.03** | **Android Layouts and UI composition** | **8 HOURS** |
| a. Assignment based on Linear and Constraint Layout.<br>b. Assignment based on List View<br>c. Assignment based on Relative, Frame and Grid Layout | | |
| **PRACTICAL NO.04** | **Database SQLite, Shared Preferences and Files** | **8 HOURS** |
| a. Assignment based on saving some string data in Shared Preference<br>b. Assignment based on saving files in mobiles<br>c. Assignment based on connecting with SQLite performs CRUD.<br>d. Assignment based on accessing public folders of android. | | |
| **PRACTICAL NO.05** | **Notifications** | **6 HOURS** |
| a. Assignment based on Broadcast Receivers<br>b. Assignment based on Services and notifications<br>c. Assignment based on Toast | | |
| **PRACTICAL NO.06** | **Firebase** | **8 HOURS** |
| a. Assignment based on adding firebase to project<br>b. Assignment based on firebase cloud messaging<br>c. Assignment based on data push | | |
| **PRACTICAL NO.07** | **Location Service and Maps** | **8 HOURS** |
| a. Assignment based on fetching device location using GPS<br>b. Assignment based on loading google map in application<br>c. Assignment based on showing device location on map<br>d. Assignment based on geocoding. | | |
| **PRACTICAL NO.08** | **Creating distributable APK and Publishing** | **12 HOURS** |
| a. Assignment on creating APK with all required security concern<br>b. Assignment based on publishing app on Play Store. | | |

**E-RESOURCES**

1. Official android doc : https://developer.android.com/docs

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | UI/UX DESIGN |
| | COURSE CODE | 2304364L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**~~PREREQUISITE KNOWLEDGE :~~**

**COURSE OBJECTIVES :**

2304364L.CEO.1: To apply the foundations of Human Computer Interaction.

2304364L.CEO.2: To Understand the design technologies for individuals and persons with disabilities.

2304364L.CEO.3: To apply the guidelines, principles and standards for user interface design.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304364L.CO.1: Identify human factors and usability issues related with computing applications. [L2].

2304364L.CO.2: Apply suitable design principles, models and usability guidelines for user interface design [L3].

2304364L.CO.3: Demonstrate the impact of usability evaluation and testing in computing applications [L2].

2304364L.CO.4: Design user interfaces using required processes and standards.[L6].

**COURSE ABSTRACT:**

UI/UX, which stands for User Interface/User Experience, is a course that focuses on creating intuitive, visually appealing, and user-friendly digital products and experiences. It combines principles from vari- ous disciplines such as design, human psychology,ergonomics and technology to enhance user satisfaction and engagement.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Understanding Human Factors – Input Output Channels , Memory, Thinking, Emotions, Ergonomics. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Identifying Faulty Designs, Miller's Principle, Models of interactions- Norman's Action Model, Gulf of Execution and Evaluation, Errors – Mistakes, Slips, Lapses and Violations, | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Understanding Design Process, Iterative Design, Navigation Design, Colors, Metaphors, Interaction Styles | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| UI design and elements current UI design patterns style guides and design systems material design and other design systems. | | |
| **PRACTICAL NO.05** | | **4 HOURS** |
| Identify specialized users and related facilities for a selected product or system and make necessary suggestions for its improved accessibility design. | | |
| **PRACTICAL NO.06** | | **4 HOURS** |
| Empathizing through Enquiry model to collect and listing of User and UX Requirements. | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Design user persona for the users of selected product or system. | | |
| **PRACTICAL NO.08** | | **4 HOURS** |
| Conduct a contextual inquiry for selected product or system. | | |
| **PRACTICAL NO.09** | | **4 HOURS** |
| Design an interface prototype for selected product or system. | | |
| **PRACTICAL NO.10** | | **4 HOURS** |

| |
|---|
| Design an interface prototype for selected product or system (GOMS, GOEE). |

| | | |
|---|---|---|
| **PRACTICAL NO.11** | | **4 HOURS** |
| Design an interface prototype for selected product or system after Peer Expert Review 1. | | |
| **PRACTICAL NO.12** | | **4 HOURS** |
| Evaluate an interface using usability evaluation technique. | | |
| **PRACTICAL NO.13** | | **4 HOURS** |
| Evaluate an interface using usability evaluation technique. | | |
| **PRACTICAL NO.14** | | **4 HOURS** |
| Expert Evaluation – Cognitive walk through and User Based Evaluation | | |
| **PRACTICAL NO.15** | | **4 HOURS** |
| Demonstration and Justification of UI/UX Design (Conclusion) | | |

| | | |
|---|---|---|
| MIT \| Academy of Engineering<br>(An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
| **DEPARTMENT OF ARTIFICIAL INTELLIGENCE** | **W.E.F** | **AY:** |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Major Project - I |
| | **COURSE CODE** | 2304391L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | NEP |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304391.CEO.1: To equip students with the ability to conduct thorough literature reviews, identifying relevant academic and industry sources.

2304391.CEO.2: To introduce fundamental design principles and methodologies applicable to engineer- ing and technology projects.

2304391.CEO.3: To teach students the basics of creating models/designs to represent systems with modelling tools and software commonly used in industry and research.

2304391.CEO.4: To understand how simulation tool can be used for iterative design improvement and optimization.

2304391.CEO.5: To guide students how to communicate their project findings clearly and concisely through written reports.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304391.CO.1: Apply mathematical, scientific, and engineering principles in the design and develop- ment of their projects [L3].

2304391.CO.2: Analyze, and solve complex engineering problems, demonstrating proficiency in research methodologies and modern tools [L4].

2304391.CO.3: Assess the societal and environmental impacts of their engineering solutions and incor- porate ethical considerations into their projects [L5].

2304391.CO.4: Communicate their project ideas and results effectively through presentations and re- ports, and work collaboratively in teams [L3].

2304391.CO.5: Apply effective project management skills, including planning, resource allocation, and adherence to timelines, while engaging in continuous learning and improvement [L3].

**COURSE ABSTRACT:**

The project is most important part of undergraduate curriculum and enables student's to develop an- alytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Project Design, Project Implementation and Project Evaluation. The first phase of Project Design mainly focuses on formulating system's requirement, background/literature review, and defining scope, objective and apply project management/modeling tools to design proposed solution. This enables students to apply their technical acumen and innova- tiveness in proposing methodology, milestones, and expected outcome.

**GUIDELINES**

1. Every project group should consist of minimum 03 and maximum of 04 students.
2. The group members may be from different programs to support the interdisciplinary functioning.
3. Project group members and title of the project need to be approved by Project Guide and DEPARTMENT .
4. Projects should preferably have a national/international industry/academic/research collabora- tion.
5. User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
6. The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.
7. Define proposed solution and apply project management/modeling tools for project planning and design.
8. Critically analyze various solutions/techniques to solve real world problems and perform feasibility study to select and justify proposed solution.
9. Define outcome, milestones, definite roadmap for project design, implementation, evaluation and documentation.

**Collaborative/Sponsored Project**

Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for project work.

Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization, anytime before the commencement of the sixth semester.

Proposed Collaborative Project work need to reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of minimum 12 months to 18 months.

Final assessment will be carried out in presence of faculty mentor, external mentor and examiner.

**TIMELINE**Proposed Methodology of the solution and its documentation.

1. Project Review II Presentation.
2. Project Documentation: Ethics in Writing
3. Project Documentation: Final Synopsis
4. Project Documentation: Project Report Writing
5. Exploration of fore front research/specialization areas and opportunities in the various fields.
6. Formation of Project Group. Finalization of area of work/title as per forefront areas.
7. Exploration of abridged courses, valid resources, challenges, relevance with current opportunities.
8. Background study Systematic literature review.
9. Literature review documentation for Project Report and Research Article.
10. Project Review I Presentation.
11. Define problem statement and objectives.
12. Define scope of the work and Outline of the work.
13. Project Design, Modelling, Simulation etc.
14. Proposed Methodology of the solution and its documentation.
15. Project Review II Presentation.
16. Project Documentation: Ethics in Writing

17. Project Documentation: Final Synopsis

18. Project Documentation: Project Report Writing

**ASSESSMENT and EVALUATION**

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

Background Study and Literature Review (10 Marks)

Synopsis (5 Marks)

Project Review I: Problem Identification, Motivation, Relevance, Background Study, Literature Review (10 Marks)

Project Review II: Literature Review, Problem Definition, Project Planning, Analysis and Design (10 Marks)

Project Report (10 Marks)

**TEXT BOOKS**

John M. Nicholas. (2012). *Project Management for Engineering, Business and Technology*. 4th Edition, Butterworth-Heinemann. ISBN 978-0080967042.

Leslie Lamport. (1994). LaTeX: *A document preparation system, User's guide and reference manual*. 2nd Edition, Addison-Wesley. ISBN 978-0201529838.

**REFERENCE BOOKS**

Michelle Reid. (2018). *Report Writing (Pocket Study Skills)*. 2nd Edition, Bloomsbury Publishing. ISBN 978-0230376557.

Sara Efrat Efron and Ruth David. (2018). *Writing the Literature Review : A Practical Guide*. 1st Edition, Guilford Press . ISBN 978-1462536894 .

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Internship (Technical) |
| | COURSE CODE | 2304396L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO | 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | NIL | 75 | 75 |

**PRE-REQUISITE :** Knowledge about the communication skills

**COURSE OBJECTIVES :**

2304396.CEO.1: To enhance technical skills and self-directed learning.

2304396.CEO.2: To develop adaptability and resilience in a multicultural or professional environment.

2304396.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2304396.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2304396.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304396.CO.1: Apply technical competencies gained through hands-on training or certification pro- grams to solve discipline-specific engineering problems [L3].

2304396.CO.2: Develop professional behavior by demonstrating teamwork, time management, and eth- ical practices in technical and industrial environments [L5].

2304396.CO.3: Evaluate personal and professional growth through critical analysis of experiential learn- ing and industry training outcomes to support career planning [L5].

2304396.CO.4: Formulate strategies addressing emerging industry needs by integrating advanced tech- nical skills with real-world insights [L4].

2304396.CO.5: Propose solution-oriented approaches to complex problems using multidisciplinary knowledge and practical exposure [L5].

2304396.CO.6: Design and deliver technical presentations and detailed reports that effectively commu- nicate practical insights and certifications to varied audiences [L5].

**INTRODUCTION:**

This internship is designed to equip third year entrants B.Tech. students with essential skills for personal and professional growth. The program emphasizes cultivating professionalism, technical expertise, and real-world problem-solving capabilities, enabling students to thrive in competitive and dynamic landscape. Through this immersive experience, students will develop a comprehensive skill set that includes technical knowledge applied through real-time projects, effective communication, teamwork, and adaptability.

A significant focus of the program is encouraging students to pursue technical certifications in core and emerging domains, thereby enhancing their technical competence and industry readiness. These certifications include, but are not limited to:

- **Programming and Development:** Java, Python, C++, and Advanced Java.
- **Database Management:** Oracle, SQL, and MongoDB.
- **Engineering Design and Simulation:** Autodesk Revit, MATLAB, ANSYS, and AutoCAD.
- **Process Simulation and Optimization:** Aspen HYSYS, Aspen Plus, and CFD (Computational Fluid Dynamics).
- **Data Analytics and Visualization:** Power BI, Tableau, and Excel Advanced Analytics.
- **Cloud Computing and Automation:** AWS (Amazon Web Services), Microsoft Azure, and DevOps Essentials.
- **AI and Machine Learning:** TensorFlow, PyTorch, and introductory courses in AI/ML appli- cations.
- **Digital Tools for Productivity:** Primavera P6 for project management and SolidWorks for design engineering.

By participating in this internship, students will gain hands-on experience in their chosen technical areas, actively apply theoretical knowledge to practical challenges, and build confidence in delivering solutions. The program also emphasizes collaboration and peer

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**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the third year of the B.Tech. program, to be undertaken during the summer break after Semester IV. This program aims to provide opportunities for skill enhancement through global certifications, technical skills training, or industrial exposure. The internship focuses on helping students identify and engage with relevant learning platforms, small-scale industries, or training opportunities to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

• **Duration:** : 3 to 4 weeks (minimum of 100 hours).

• **Timeframe:** Conducted during June-July of each academic year.

• **Nature of Internship:**

1. Technical skills training programs.
2. Industrial training with companies or small-scale industries.
3. Certifications in core technical fields such as programming, database management, design, simula- tion, and data analysis.

• **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.

• **Mentorship:** Each second-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

**Internship Format and Personal Development Focus:**

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development. **Student Development Focus :**

Before selecting an internship option, second-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. The program places significant emphasis on pursuing technical certification programs in areas such as programming, database management, engineering design, simulation, data analytics, and more. These certifications will enhance students' technical expertise and provide them with a competitive edge in the industry, preparing them for future academic and career success.

Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures reg- ular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

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**Continuous Assessment (CA): Biweekly Progress Reports and interaction with faculty mentor (40%):**

Students must submit at least two progress reports during the internship/training period. Each report should clearly document:

Activities performed

Skills or concepts learned

Challenges faced and strategies used to overcome them

**Detailed Project Report with Learning Outcomes (30%)**

Upon completion of the internship, students are required to submit a comprehensive minimum of 20 to 25 pages' internship/project report. The report must include:

Overview of the Industry/Research Institute

Skills and knowledge acquired (technical/soft/life)

Specific challenges addressed

Personal and professional growth reflections

Clearly stated learning outcomes

The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certificate (30%):**

Students will deliver a final presentation summarizing their internship experience and learning outcomes.

A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **DEPARTMENT OF ARTIFICIAL INTELLIGENCE** | **W.E.F** | **AY:** |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | SOFTWARE ENGINEERING |
| | **COURSE CODE** | 2304313T |
| | **COURSE CREDITS** | 3 |

| RELEASE DATE : | REVISION NO. | |
|---|---|---|

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Prototyping

**COURSE OBJECTIVES :**

2304313T.CEO.1: To explore the software process models.

2304313T.CEO.2: To process requirement engineering and modeling for product development.

2304313T.CEO.3: To estimate and manage software metrics.

2304313T.CEO.4: To understand the test driven environment in software development. 2304313T.CEO.5: To illustrate DevOps lifecycle and different tools

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304313T.CO.1: Classify SDLC process models.[L4]

2304313T.CO.2: Analyze conformance of the requirement and modeling related to project develop- ment.[L4]

2304313T.CO.3: Apply mitigation techniques for the risk associated with project development.[L3]

2304313T.CO.4: Evaluate the schedule, cost and staff associated with project. [L5] 2304313T.CO.5: Apply different DevOps tools for project development. [L3]

**COURSE ABSTRACT:**

The Software Engineering course provide preparation for careers in system development, project management, and quality assurance with cutting-edge tools and methodologies. Enhance technical skills and problem-solving abilities essential for top tech roles.

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **Basics of Software Engineering** | **08 HOURS** |
| **Applications/Case Study:** Learning Game Design and Software Engineering through a Game Pro- totyping Experience<br>**Contents:** Generic process model: Process framework, umbrella activities, Process Adaptation, Per- spective Process Models - Waterfall Model, Prototyping, Incremental, and Agile Process Model: XP and Scrum, introduction to Principles of framework Activities, DevOps concepts and process<br>**Self Study:** Component based development process model.<br>**Further Readings:** Dynamic System Development Method. | | |
| **UNIT 2** | **Requirement Analysis and Modelling** | **09 HOURS** |
| **Applications/Case Study:** Online Marketing Software Platform<br>**Contents:** Requirement Engineering, Scenario based requirement modeling, Class based requirement modeling, Behavior based requirement modeling, Requirement modeling for web and mobile apps, Design Concepts, Design models, Architectural design, Static and Dynamic UML Diagrams: Class diagram, Object diagram, Use case, Activity diagram, Sequence diagram, Block diagram, Architectural diagram and Deployment diagram<br>**Self Study:**Interaction Model for Web and Mobile Apps<br>**Further Readings:**Configuration Models for Web Apps. | | |
| **UNIT 3** | **Process Management and Estimation** | **08 HOURS** |
| **Applications/Case Study:** Successful Application of Software Reliability by Norman F. Chnei- dewind<br>**Contents:** Software Configuration Management, Software Project Planning: Project Planning objec- tives, Software Metrics: Size, Function Point, Staffing, Project Estimation Methods Decomposition Techniques, Empirical Estimation Models COCOMO Model, Risk Management: Risk Identification, Analysis, mitigation methods<br>**Self Study:** Software Quality ISO Standards<br>**Further Readings:**ISO/IEC 9126 Software engineering | | |
| **UNIT 4** | **Test Driven Development** | **08 HOURS** |

| |
|---|
| **Applications/Case Study:** Manual Testing (Online Marketing Software Platform)<br>**Contents:** System Testing - System Integration Techniques - Incremental, Top-Down Bottom, White box Testing, Black box Testing, Performance Testing, Security Testing, Acceptance testing<br>**Self Study:** Automated Testing life cycle<br>**Further Readings:**Software Reliability |

| UNIT 5 | DevOps and Automation | 12 HOURS |
|---|---|---|
| **Applications/Case Study:** Maven and Puppet<br>**Contents:**Introduction to DevOps life cycle, DevOps tools, Version Control System, GIT, Continuous Integration, Jenkin, Containerizing the applications, Docker life cycle, Docker commands, Kubernetes components, Kubernetes master slave architecture, Namespace, Application deployment in kubernetes cluster, Configuration management, Ansible architecture, Setting up master slave using ansible, Ansible playbook, Roles, Configurations using ansible, continuous monitoring, Nagios, Nagios Architecture, Nagios commands, Nagios plugins, Nagios notification<br>**Self Study:** GCP Cloud Computing and Storage in DevOps<br>**Further Readings:** Appdynamics | | |

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**COURSE SYLLABUS**

| | |
|---|---|
| **DEPARTMENT OF ARTIFICIAL INTELLIGENCE** | **AY:** **W.E.F** |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** |
| | **COURSE CODE** 2304313L |
| | **COURSE CREDITS** 1 |
| **RELEASE DATE :** | **REVISION NO.** |

**COURSE OBJECTIVES :**

2304313L.CEO.1: To explore the software process model.
2304313L.CEO.2: To process requirement engineering and modeling for product development.
2304313L.CEO.3: To estimate and manage software metrics.
2304313L.CEO.4: To understand the test driven environment in software development. 2304313L.CEO.5: To illustrate DevOps lifecycle and different tools.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,
2304313L.CO.1: Analyze conformance of the requirement and modeling related to project develop- ment.[L4]
2304313L.CO.2: Apply mitigation techniques for the risk associated with project development. [L3]
2304313L.CO.3: Demonstrate the usage of tools for project development phases. [L3]

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

| **PREREQUISITE :** |
|---|
| Prototyping |

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | A. Students are required to take a real-life scenario for software development (ERP, Mobile app, IoT project) and apply a correct Development paradigm for it with justification.<br>OR<br>Students can take mini or minor project/ DBMS project / DSF Project and explain which software development paradigm was used, what were the limitations of that paradigm. Students should propose a revised paradigm to overcome the limitations of existing one with justification.<br>B. For the project, make a SRS in IEEE format. | 6 HOURS |
| Furthe practice NIL<br>r : | | |
| **PRACTICAL NO.02** | Take your problem statement and design modelling using UML Diagrams. | 4 HOURS |
| Furthe practice NIL<br>r : | | |
| **PRACTICAL NO.03** | Prepare a suitable cost estimation model, WBS, Gantt chart (using MS project tool) and all neces- sary estimation for your project. | 4 HOURS |
| Furthe practice NIL<br>r : | | |
| **PRACTICAL NO.04** | Prepare the risk mitigation plan for the selected project. | 4 HOURS |
| Furthe practice NIL<br>r : | | |

| | | |
|---|---|---|
| **PRACTICAL NO.05** | Design test driven process for project based on associated risk and possible threats. | 4 HOURS |
| Further practice: | NIL | |
| **PRACTICAL NO.06** | Use and demonstration of any two Devops tools for the project. | 4 HOURS |
| Further practice: | NIL | |
| **PRACTICAL NO.07** | Final presentation: Report and PPT | 4 HOURS |
| Further practice: | NIL | |

**REFERENCE BOOKS**

1. Mitesh Soni (2017). *Jenkins Essentials*. 2$^{ed}$ Edition , Packt Publishing Limited, ISBN-13 978-1783553471

**TEXT BOOKS**

Joakim Verona (2016), *Practical DevOps* , Packt Publishing Limited, 1$^{ed}$ Edition,O'Reilly Media Inc, ISBN-13 978-9352133765

Jennifer Davis Ryn Daniels, (2017) *Jenkins Essentials*. 2$^{ed}$ edition, Packt Publishing Limited, ISBN-13 978-1783553471

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY DEPARTMENT OF ARTIFICIAL INTELLIGENCE | COURSE NAME | DESIGN AND ANALYSIS OF ALGORITHMS |
| | COURSE CODE | 2304314T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : 01/07/2025 | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :**

Calculus and differential equation, Foundation of Computing

**COURSE OBJECTIVES :**

2304314T.CEO.1: To develop problem solving abilities using mathematical theories.

2304314T.CEO.2: To apply algorithmic strategies while solving problems.

2304314T.CEO.3: To analyze performance of different algorithmic strategies in terms of time.

2304314T.CEO.4: To distinguish between P and NP class of problems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304314T.CO.1: Analyze the given algorithm in terms of its computational complexity. [L4]. 2304314T.CO.2: Apply algorithmic strategies to solve given problems. [L3].

2304314T.CO.3: Find optimal solution by applying various methods. [L3].

2304314T.CO.4: Solve intractable problem by using approximation algorithm. [L3].

2304314T.CO.5: Make use of string matching algorithm to find matches between specified pattern. [L3].

**COURSE ABSTRACT:**

This course introduces the mathematical notion of algorithms and teaches how to develop, validate, and optimize them for performance and memory. The course includes a significant mathematics component, as well as the design of various algorithms.

**THEORY COURSE CONTENTS**

| UNIT 1 | INTRODUCTION OF ALGORITHMIC STRATEGY | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Packet switched network, Binary Search.

**Contents:** Algorithm, performance analysis, Need of Algorithm,Asymptotic Notation, Problem solving strategies Divide and Conquer: Basic method, Example: Quick Sort, Max-Min Problem, Large integer multiplication algorithm, Recurrence: Substitution method, Master Theorem.

**Self Study:** Median of Two sorted arrays of same size.

**Further Readings:** Strassen's Matrix Multiplication.

| UNIT 2 | GREEDY METHOD | 06 HOURS |
|---|---|---|

**Applications/Case Study:** CPU Scheduling Algorithms, Network Routing

**Contents:** Greedy Algorithm: Basic Method and Algorithms, Example: Fractional Knapsack Problem, Job Sequencing with Deadline, Huffman Algorithm, Activity Selection Problem.

**Self Study:**Coin Changing Problem

**Further Readings:**Task scheduling problem as a matroid.

| UNIT 3 | DYNAMIC PROGRAMMING | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Google Map, Google search engine

**Contents:** Dynamic Programming: Basic Method, Example: 0/1 Knapsack, Chain Matrix Multipli- cation OBST, All pairs shortest path, Floyd-Warshall's Algorithm, Travelling Salesman Problem.

**Self Study:** Coin changing problem.

**Further Readings:**Longest common Subsequence Problem.Single source shortest path: Bellman Ford algorithm.

| UNIT 4 | BACKTRACKING AND BRANCH AND BOUND | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Parser, Crossword puzzle, Sudoku.

**Contents:** Backtracking: Basic Method, Examples: Eight Queen Problem, Sum of Subset prob- lem,Branch and Bound: Basic Method, FIFO and LC approach, 0/1 knapsack problem using FIFO LC Approach, Traveling Salesperson problem FIFO LC Approach

**Self Study:** Backtracking Algorithms for Enumerating Independent Sets of a Graph.

**Further Readings:**15 Puzzle problem.

| UNIT 5 | COMPUTATIONAL COMPLEXITY THEORY | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Airline crew scheduling, TSP and Graph coloring problem.
**Contents:** Classifying Problems, Nondeterministic Deterministic problems, Tractable Non Tractable problems, Reductions, Cook's Theorem, NP-Complete problem, NP-Hard problem,3SAT Problem Ap- proximation algorithm: vertex cover problem.
**Self Study:** Approximation algorithm for TSP.
**Further Readings:** Clique Decision problem.

| UNIT 6 | ADVANCED ALGORITHMS AND APPLICATIONS | 08 HOURS |
|---|---|---|

**Applications/Case Study:** plagiarism detector, spell checker, web search engines
**Contents:** Randomized algorithms : Monte Carlo and Las Vegas algorithm, String matching algo- rithm: KMP, Boyer Moore Algorithm, Robin Karp Algorithm, Number theoretic algorithm: : the GCD – Modular Arithmetic – The Chinese Remainder Theorem.
**Self Study:** Na¨ıve string matching algorithm.
**Further Readings:** The general string problem as a finite automata.

**TEXT BOOKS**


E.Horowitz , S. Sahni, S. Rajasekaran (2008) *Fundamentals of Computer Algorithms*. 2nd Edition, Universities Press pvt Ltd ,ISBN 9788173716126.

Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein (2022) *Introduction to Algorithm*. 4th edition, Cambridge, Massachusetts : The MIT Press, ISBN 9780262367509.

3. Anany Levitin *Introduction to the Design and Analysis of Algorithms*. 3rd edition,ISBN: 9780132316811.


**REFERENCE BOOKS**


V. Aho , J.D. Ullman,(2002)*Design and Analysis of Computer Algorithms*. 1st Edition , Pearson Education , ISBN 8131702057 PHI Learning Pvt Ltd, 2011, ISBN 978-81-203-40007-7.

Brassard G. and Bratley P.*Algorithms, Theory and Practices*. 1st Edition , PHI. ISBN 0-13-023243-2.


**E-RESOURCES**

1. https://nptel.ac.in/courses/106101060

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | DESIGN AND ANALYSIS OF ALGORITHMS LAB |
| | COURSE CODE | 2304314L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**COURSE OBJECTIVES :**

**PREREQUISITE KNOWLEDGE :**

Calculus and differential equation, Foundation of Computing

2304314L.CEO.1: To design an efficient algorithm for any specified problem.

2304314L.CEO.2: To carry out the analysis of various algorithms in terms of its computational com- plexity.

2304314L.CEO.3: To identify appropriate algorithmic design strategies to optimize the performance of a given problem.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304314L.CO.1: Design algorithms using appropriate design Techniques [L3]. 2304314L.CO.2: Implement a variety of algorithms in a high level language. [L3]

2304314L.CO.3: Apply and implement learned algorithm design techniques to solve real-world prob- lems.[L3].

2304314L.CO.4: Analyze algorithms to deduce their time complexities. [L5].

**COURSE ABSTRACT:**

This course introduces the mathematical notion of algorithms and teaches how to develop, validate, and optimize them for performance and memory. The course includes a significant mathematics component, as well as the design of various algorithms.

| | | |
|---|---|---|
| **PRACTICALS** | | |
| **PRACTICAL NO.01** | **Design and implement various applications of divide and conquer approach.** | **4 HOURS** |
| Further practice: Strassen's Matrix Multiplication | | |
| **PRACTICAL NO.02** | write a program to solve applications using Greedy Approach. Calculate the time complexity of the algorithm. | **4 HOURS** |
| Furthe practic NIL r e: | | |
| **PRACTICAL NO.03** | Design and implement problem using dynamic approach. Calculate the time complexity of the algorithm. | **6 HOURS** |
| Further practice: Coin Changing | | |
| **PRACTICAL NO.04** | Write a program to solve application of branch and bound approach. | **4 HOURS** |
| Further practice: Sum of Subset | | |
| **PRACTICAL NO.05** | Design and Implement application based on backtracking approach. | **4 HOURS** |
| Further practice: Graph coloring | | |
| **PRACTICAL NO.06** | Design and Implement the string matching algorithm. | **4 HOURS** |
| Further practice: Rabin Karp | | |
| **PRACTICAL NO.07** | **Design and Implement randomized algorithms.** | **4 HOURS** |
| Further practice: Quick Sort | | |

**TEXT BOOKS**


1. E.Horowitz , S. Sahni, S. Rajasekaran (2008). *Fundamentals of Computer Algorithms*. 2nd Edition, Universities Press pvt Ltd , ISBN 9788173716126.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein (2022) *Introduction to Algorithm*. 4th edition, Cambridge, Massachusetts : The MIT Press, ISBN 9780262367509.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | PREDICTIVE ANALYTICS |
| | COURSE CODE | 2304326T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Descriptive Analytics

**COURSE OBJECTIVES :**

2304326T.CEO.1: To summarize the Supervised Learning Methods. 2304326T.CEO.2: To understand the advanced classification techniques. 2304326T.CEO.3: To explain Artificial Neural Network.

2304326T.CEO.4: To understand Clustering Techniques.

2304326T.CEO.5: To understand Deep learning and Natural Language Processing.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304326T.CO.1: Apply the classification and prediction techniques to solve real world problems[L3[. 2304326T.CO.2: Use advanced classification techniques[L3].

2304326T.CO.3: Apply artificial neural network (ANN) for implementing Deep Learning models[L3]. 2304326T.CO.4: Implement different clustering techniques[L3[.

2304326T.CO.5: Implement different ensemble learning techniques[L3]. 2304326T.CO.6: Solve real world problems using deep learning models and NLP [L3].

**COURSE ABSTRACT:**

Predictive analytics is a powerful field that leverages data science to make informed decisions, antici- pate future trends, and optimize strategies across various domains. This comprehensive course delves into advanced predictive analytics methodologies, equipping participants with the knowledge and skills necessary to extract actionable insights from data.Throughout the course, participants will explore cutting-edge techniques including advanced classification, artificial neural networks (ANNs), deep neu- ral networks (DNNs), Ensemble Learning methods, clustering techniques, and ensemble techniques.

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **CLASSIFICATION AND PREDICTIONS** | **08 HOURS** |

**Applications/Case Study:** House price prediction Case

**Contents:** Classification and Prediction, Decision Tree-Based Classification-(c.4.5), Probabilistic Clas- sification: Naive Bays Classification, Bayesian Belief Network (BBN), Eager Learning, Lazy Learning, K-Nearest neighbor- KNN. Support Vector Machine (SVM), Soft Versus Hard Margin, Local and Global Minima,

**Self Study:** Classification Assessment

**Further Readings:** A fast Scalable Classifier for Data mining

| **UNIT 2** | **CLUSTERING TECHNIQUES** | **06 HOURS** |
|---|---|---|

**Applications/Case Study:** Online Shopping Case Study

**Contents:** Basics of Clustering, Quality Parameters of Clustering, Various Clustering Approaches. Partitioning Methods: K-Means, K-Medoids (Partition Around Medoids), Hierarchical Methods: Ag- glomerative and Divisible Clustering. Expectation Maximiza- tion (EM) Algorithm, Discussion On EM.

**Self Study:** Spectral Clustering.

**Further Readings:** Graph Clustering.

| **UNIT 3** | **ARTIFICIAL NEURAL NETWORK** | **08 HOURS** |
|---|---|---|

**Applications/Case Study:** Automatic car Case Study

**Contents:** Artificial Neural Network (ANN): Neurons, perceptron, parameter settings of ANN, Topolo- gies of ANN, transfer functions, learnings in ANN, Activation functions, Learning rate, Gradient de- scent, Back- Propagation, Basic forms of Neural processing, Advantages and Limitations of ANN. In- troduction to deep learning , Deep learning models.

**Self Study:** Convolutional Neural Networks.

**Further Readings:** Deep Architecture.

| UNIT 4 | NATURAL LANGUAGE PROCESSING (NLP) | 07 HOURS |
|---|---|---|

**Applications/Case Study:** Social media Anallytics

**Contents:** NLP Introduction, Part of S Tagging, Part Of Speech tagging approaches: HMM for POS. A large language model (LLM) introduction, Training and working of LLM. Applications of LLM using case study.

**Self Study:** NLP- Stop word removal, Stemming, lemmatization,topic modeling

**Further Readings:** Fine tuning of LLM

| UNIT 5 | DEEP LEARNING | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Disease Classification Using CNN.

**Contents:** CNN architecture overview, The Basic Structure of a Convolutional Network-Padding, Strides, Typical Settings, the ReLU layer, Pooling, Fully Connected Layers, Training a Convolutional Network. Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder, The Challenge of Long- Term Dependencies, The Long Short-Term Memory. Design neural network architectures for new data problems based on their requirements and problem characteristics, and analyze their performance.

**Self Study:** Long Short-Term Memory Networks (LSTMs)

**Further Readings:** Fine Tuning RNN Models

| UNIT 6 | GENERATIVE ADVERSARIAL NETWORKS | 07 HOURS |
|---|---|---|

**Applications/Case Study:** FaceAPP

**Contents:** Introduction to Generative Models, working principle of GAN, Role of the discriminator, generator, Mode Collapse and Problems with BCE Loss , Training vs. Inference, Earth Mover's Dis- tance (Wasserstein Distance), Wasserstein-Loss, Condition on W-loss Critic, 1-Lipschitz Continuity Enforcement..

**Self Study:** DCGANs

**Further Readings:** CycleGAN for image translation

**TEXT BOOKS**


Murrey R Spiegal, Larry Stifens, "Statistics" , 5th edition ,Schaum's Series, McGraw-Hill Education; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527

Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.

Alpaydin, E. (2010). Introduction to Machine Learning. MIT Press.

Franc¸ois Chollet, Deep Learning with Python, Manning Publications.

Stefano van der Walt and Sharon Zhou, Hands-On Generative Adversarial Networks with PyTorch

x: Implement next-generation neural networks to build powerful GAN models using

**REFERENCE BOOKS**

Murrey R Spiegal, Larry Stifens, “Statistics” , 5th edition ,Schaum’s Series, McGraw-Hill Education; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527

Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.

Alpaydin, E. (2010). Introduction to Machine Learning. MIT Press.

Franc¸ois Chollet, Deep Learning with Python, Manning Publications.

Stefano van der Walt and Sharon Zhou, Hands-On Generative Adversarial Networks with PyTorch

x: Implement next-generation neural networks to build powerful GAN models using Python, Packt Publishing.

**E-RESOURCES**

https://doi.org/10.1145/3234150

https://www.sciencedirect.com/science/article/pii/S1574013721000198?via

https://ieeexplore.ieee.org/document/10193469/

https://doi.org/10.1007/s40745-015-0040-1

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | PREDICTIVE ANALYTICS LAB |
| | COURSE CODE | 2304326L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Descriptive Analytics

**COURSE OBJECTIVES :**

2304326L.CEO.1: To understand the advanced classification techniques.
2304326L.CEO.2: To use the basic terminology of artificial neural networks.
2304326L.CEO.3: To understand the deep neural networks..
2304326L.CEO.4: To illustrate the unsupervised learning methods. 2304326L.CEO.5: To explain basic terminology of natural language processing. 2304326L.CEO.6: To explain ensemble learning.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304326L.CO.1: Apply predictive analytics techniques to solve a given problems. [L3] 2304326L.CO.2: Select efficient analytics techniques for multimedia dataset.[L3].
2304326L.CO.3: Infer from the survey of existing preditive algorithms and methods.[L4] 2304326L.CO.4: Create an application to solve any real world problem using appropriate predictive analytics techniques.[L6]

**COURSE ABSTRACT:**

Predictive analytics is a powerful field that leverages data science to make informed decisions, antici- pate future trends, and optimize strategies across various domains. This comprehensive course delves into advanced predictive analytics methodologies, equipping participants with the knowledge and skills necessary to extract actionable insights from data.Throughout the course, participants will explore cutting-edge techniques including advanced classification, artificial neural networks (ANNs), deep neu- ral networks (DNNs), Ensemble Learning methods, clustering techniques, and ensemble techniques

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Implementation of classification algorithms (any two ) (Na¨ıve bays, BBN, KNN, CART,SVM etc)** | **4 HOURS** |
| Further practice: Develop a application using any front end tool to use classification algorithm, | | |
| **PRACTICAL NO.02** | **Problem solving using clustering algorithm** | **4 HOURS** |
| Further practice: Implement any one advance clustering techniques. | | |
| **PRACTICAL NO.03** | **Deep learning applications for given case study.** | **4 HOURS** |
| Apply hypertunning paramter to increase the accuracy of deep neural netwok | | |
| **PRACTICAL NO.04** | **Application of Hidden Markov Model for solving problem of natural language processing.** | **4 HOURS** |
| Further practice: Student has to apply for HMM for Part of Speech problem. | | |
| **PRACTICAL NO.05** | **Apply Adversarial Neural Network** | **4 HOURS** |
| Further practice: Evaluate the performance analysis. | | |
| **PRACTICAL NO.06** | **Mini Project** | **10 HOURS** |
| Data science solution for real word problems – project ( group 3 ) duration 1 month ( Problems include image processing, video processing will be preferred) Real life problem statements from associated industries will be shared with students and assessment will be done with the help of industry experts. These problems would cover all branches of engineering. The project includes survey of existing model. Finding researh gap and providing methods/idea for improvement. Implementation of Methods/Ideas. Inference from the experimentation. | | |

**TEXT BOOKS**

Murrey R Spiegal, Larry Stifens, “Statistics” , 5th edition ,Schaum’s Series, McGraw-Hill Education; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527

Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.

Alpaydin, E. (2010). Introduction to Machine Learning. MIT Press.

Franc¸ois Chollet, Deep Learning with Python, Manning Publications.

Stefano van der Walt and Sharon Zhou, Hands-On Generative Adversarial Networks with PyTorch

x: Implement next-generation neural networks to build powerful GAN models using

**REFERENCE BOOKS**

Murrey R Spiegal, Larry Stifens, “Statistics” , 5th edition ,Schaum’s Series, McGraw-Hill Education; 5 edition, ISBN-10: 0071822526 , ISBN-13: 978-0071822527

Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press.

Alpaydin, E. (2010). Introduction to Machine Learning. MIT Press.

Franc¸ois Chollet, Deep Learning with Python, Manning Publications.

Stefano van der Walt and Sharon Zhou, Hands-On Generative Adversarial Networks with PyTorch

x: Implement next-generation neural networks to build powerful GAN models using Python, Packt Publishing.

**E-RESOURCES**

https://doi.org/10.1145/3234150

https://www.sciencedirect.com/science/article/pii/S1574013721000198?via

https://ieeexplore.ieee.org/document/10193469/

https://doi.org/10.1007/s40745-015-0040-1

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | DEEP LEARNING |
| | COURSE CODE | 2304327T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Statistics and Integral Calculus, Artificial Intelligence and Machine learning

**COURSE OBJECTIVES :**

2304327T.CEO.1: Develop a comprehensive understanding of the mathematical foundation of neural network employed on static and dynamic data set.

2304327T.CEO.2: Apply algorithms to solve real-world problems in computer vision, natural language processing, and other domains.

2304327T.CEO.3: To analyze the performance of various approaches of deep learning algorithms.

2304327T.CEO.4: Handle techniques for evaluating and fine-tuning model performance.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304327T.CO.1: Model the mathematical intuition of underlying neural networks for its application to both static and dynamic datasets[L3].

2304327T.CO.2: Apply relevant deep learning algorithms to develop intelligent systems in various real world domains[L3]

2304327T.CO.3: Evaluates the performance of intelligent models using various evaluation techniques and metrics[L5].

2304327T.CO.4: Fine-tune hyper-parameters to optimize intelligent models[L4].

2304327T.CO.5: Analyse the relative advantages and limitations of various deep learning algo- rithms[L5].

**COURSE ABSTRACT:**

This course explores deep learning in artificial intelligence, covering its fundamental principles, methodologies, and practical applications. It covers neural networks, convolutional and recurrent neural networks, and their applications in image classification, object detection, segmentation, natural language processing, and time series analysis. The course also covers reinforcement learning and transfer learning techniques. The course emphasizes both theoretical understanding and practical implementation, combining lectures with hands-on exercises and projects. Students gain a comprehensive understanding of deep learning concepts and skills in applying these techniques to real-world datasets and challenges. This equips students with the knowledge and proficiency to contribute to AI-driven solutions across various industries.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Fundamental of Neural network** | **07 HOURS** |

**Applications/Case Study:** Customer Engagement

**Contents:**Neural Network Contents: Neural Network: Introduction to Neural Networks, Fundamental Concepts: Neuron Models And Basic Learning Rules, Perceptron Training Rule, Gradient Descent And Delta Rule, Back- Propagation Algorithm,Loss Functions, Multi layer Network,Regularization techniques.

**Self Study:** Activation Function

**Further Readings:** Optimization Algorithms

| | | |
|---|---|---|
| **UNIT 2** | **Deep Convolutional Neural network** | **08 HOURS** |

**Applications/Case Study:** Chest X Ray Image Classification

**Contents:**Convolutional Neural Network (CNN)Architecture, Activation Functions, Training and Back-propagation Transfer Learning:Approaches,Pre-trained Models,Fine-tuning and Feature Extrac- tion. Object Detection: Faster R-CNNs, YoLO,evaluation metrics.

**Self Study:**RetinaNet

**Further Readings:**Graph Convolutional Neural Networks

| | | |
|---|---|---|
| **UNIT 3** | **Deep Quantum Computing** | **08 HOURS** |

**Applications/Case Study:** Quantum-enhanced image classification

**Contents:** Quantum Mechanics Foundations,Quantum Gates and Circuits,Quantum Algorithms,Overview of Quantum CNN,Architecture of Quantum CNN, Quantum CNN Operations simu- lators -IBM's Qiskit, PennyLane, or Google's Cirq.

**Self Study:** Quantum Error Correction

**Further Readings:**Quantum Hardware

| UNIT 4 | Time Series Analysis | 08 HOURS |
|---|---|---|
| **Applications/Case Study:** Marketing and Customer Analytics<br>**Contents:** Time Series Data,Time Series Decomposition Statistical Models:Autoregressive Inte- grated Moving Average (ARIMA), Forecasting Techniques, Sequence Model,Understanding sequential data,Types of sequence models,Hidden Morkow Model,Recurrent Neural Network,Vanishing gradient Problem,Long Short term Memory,Gated Recurrent Unit,mathematical modeling of behind sequence model.<br>**Self Study:** Seasonal Decomposition of Time Series (STL)<br>**Further Readings:**Stochastic recurrent neural network | | |
| **UNIT 5** | **Sequence to Sequence Models** | **08 HOURS** |
| **Applications/Case Study:** Text Summarization and Machine Translation<br>**Contents:**Overview of Natural language processing, Introduction to Seq2Seq models,Encoder-Decoder Architecture,Attention Mechanism, Transformer-based Seq2Seq Models: Introduction of transformer architecture and self-attention mechanisms for parallelized computation,Handling Variable-Length Se- quences,Evaluation Metrics: BLEU for machine translation and ROUGE for summarization.<br>**Self Study:** Teacher Forcing,Beam Search<br>**Further Readings:** Fine-tuning encoder and decoder | | |
| **UNIT 6** | **Explainable AI** | **06 HOURS** |
| **Applications/Case Study:** Interpreting Diabetes Risk Predictions.<br>**Contents:** Introduction to Explainable AI,Model-Specific, Model-Agnostic:LIME (Local Interpretable Model-agnostic Explanations): Approximating models with simple interpretable ones. SHAP (SHapley Additive exPlanations).<br>**Self Study:**Trends in research (causality in XAI, human-centered AI). The role of XAI in AI governance and regulation.<br>**Further Readings:** Ethical considerations: Bias, fairness, and regulatory compliance (GDPR, etc.) | | |

**TEXT BOOKS**

Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016). *Deep Learning*. 1st Edition, The MIT Press . ISBN 978-0262035613.

Aur´elien G´eron(2019) *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition*. 1st Edition,Packt Publishing. ISBN 9781492032649.

**REFERENCE BOOKS**

Maxim Lapan.(2018).*Deep Reinforcement Learning Hands-Ons*Packt Publishing. ISBN 978-1788834247

Seth Weidman.(2019).*Deep Reinforcement Learning Hands-Ons*Packt Publishing. ISBN 978-1788834247

**E-BOOKS/E-CONTENTS LINKS**

Dive into Deep Learning:Aston Zhang, Zachary C. Lipton, Mu Li, And Alexander J.Smola. (2024). *Dive into Deep Learning* Paperback. ISBN 1009389432. link- https://d2l.ai/d2l-en.pdf

https://developer.nvidia.com/deep-learning

https://builtin.com/machine-learning/deep-learning

https://www.deeplearningbook.org/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | DEEP LEARNING LAB |
| | COURSE CODE | 2304327L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Statistics and Integral Calculus, Artificial Intelligence and Machine learning

**COURSE OBJECTIVES :**

2304327L.CEO.1: Develop hands-on skills to implement and train deep learning models using popular frameworks.

2304327L.CEO.2: Identify problems that can be effectively addressed using deep learning solutions.

2304327L.CEO.3: Evaluate the performance of deep learning models using evaluation metrics.

2304327L.CEO.4: Assess the strengths and limitations of different deep learning approaches.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304327L.CO.1: Develop critical thinking skills by solving real-world problems using deep learning algorithm.[L4]

2304327L.CO.2: Investigate strategies for improved model generalization, reducing overfitting, enhanc- ing unseen performance.[L4]

2304327L.CO.3: Optimize models by fine-tuning hyperparameters for task-specific and dataset-specific optimal performance.[L5]

2304327L.CO.4: Discuss results to draw conclusions on problem-solving method effectiveness.[L5]

2304327L.CO.5: Improve collaboration through group discussions, sharing insights, and contributing to DL projects in lab settings. [L5]

**COURSE ABSTRACT:**

This course explores deep learning in artificial intelligence, covering its principles, methodologies, and practical applications. Students will learn about neural networks, convolutional neural networks, and recurrent neural networks, and their roles in tasks like image classification, object detection, segmentation, natural language processing, and time series analysis. The course combines theoretical understanding with practical implementation through lectures, exercises, and projects. Lab components include hands- on exercises, project-based assignments, experimentation with pre-trained models, and integration with web applications. Students will gain a comprehensive understanding of deep learning principles and methodologies.

**PRACTICALS**

| | | |
|---|---|---|
| **PRACTICAL NO.01** | **Neural Networks design and deployment** | **4 HOURS** |

1. Model Development: Design and train the neural network with appropriate architecture, loss function, optimizer, and data handling techniques, ensuring model accuracy and performance through evaluation and hyperparameter tuning.

| | | |
|---|---|---|
| **PRACTICAL NO.02** | **Transfer Learning** | **6 HOURS** |

1. Transfer Learning Model Development: Fine-tune a pre-trained model on your specific dataset, adjusting the top layers and optimizing hyperparameters to achieve desired performance metrics.

| | | |
|---|---|---|
| **PRACTICAL NO.03** | **Object Detection and Multi object classification** | **4 HOURS** |

1. Dataset Preparation and Model Design: Select and preprocess a dataset with annotations for object detection, segmentation masks, and class labels. Design a deep learning architecture that integrates object detection, segmentation, and recognition tasks.
2. Model Training and Optimization: Train the multi-task model, experiment with hyperparameters, and fine-tune using transfer learning. Implement optimization techniques to enhance performance.
3. Evaluation and Visualization: Evaluate the model on a test dataset, create visualizations of predictions, and discuss challenges and potential real-world applications.

| | | |
|---|---|---|
| **PRACTICAL NO.04** | **Natural Language Processing** | **4 HOURS** |

1. Data Preparation: Obtain a dataset with sentiment labels, clean the data using NLP tools, and visualize sentiment distribution.
2. Text Representation and Model Training: Convert text to numerical vectors using TF-IDF or word embeddings, implement a baseline model, and split the dataset into training and testing sets.
3. Evaluation and Conclusion: Evaluate models on the test set using relevant metrics, summarize key findings, suggest improvements, and recommend future research directions.

| | | |
|---|---|---|
| **PRACTICAL NO.05** | **Sequence Classification** | **4 HOURS** |

1. Development: Design and train a deep sequence model (e.g., RNN, LSTM, GRU, Transformer) using a suitable dataset for sequence classification tasks, ensuring to preprocess the data appro- priately and tune hyperparameters for optimal performance.
2. Evaluation: Validate the model's performance on a separate test set, using metrics like accuracy,
   precision, recall, and F1-score to assess its effectiveness in classifying sequences accurately.

| PRACTICAL NO.06 | Sequence Generation | 6 HOURS |
|---|---|---|

1. Model Design and Training: Construct and train a deep sequential model (e.g., LSTM, GRU, Transformer) on a dataset of sequences, focusing on generating new sequences by learning patterns from the input data.
2. Evaluation and Fine-tuning: Assess the model's ability to generate coherent and relevant se- quences by comparing generated sequences against a validation set, and fine-tune the model's parameters to improve generation quality.

| PRACTICAL NO.06 | Mini Project (Object detection/NLP). | 6 HOURS |
|---|---|---|

1. The mini project aims to create a real-time object detection/langauge based web application that uses a pre-trained deep learning model to identify objects in a live webcam feed or dynamic data.
2. The project involves selecting a suitable dataset and model, pre-processing the data, integrating the model, developing the web application, deploying it, and documenting the project.
3. The project will take five weeks, with a maximum of three students participating. The team will prepare a project plan, select a real-time dataset, and select a pre-trained model.
4. The project will also involve data pre-processing, model integration, web application development, deployment, and documentation.
5. Regular communication and collaboration will be maintained throughout the project, with the goal of having a fully functional real-time object detection or NLP web application ready for deployment.

**TEXT BOOKS**

Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016). *Deep Learning*. 1st Edition, The MIT Press . ISBN 978-0262035613.

Rajalingappaa Shanmugamani(2018) *Deep Learning for Computer Vision*. 1st Edition,Packt Pub- lishing. ISBN 978-1788295628.

Aur´elien G´eron(2019) *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*. 1st Edition O'Reilly Media. ISBN 978-149203264

**REFERENCE BOOKS**

A. B. A. Arriola, J. R. G. de C. Santos, and J. A. de Morais Amado.(2021). *Quantum Neural Networks*,Springer Publishing. ISBN: 978-3030641911

Seth Weidman.(2019).*Deep Reinforcement Learning Hands-Ons*Packt Publishing. ISBN 978-1788834247

Parikshit N. Mahalle and Poonam N.(2021) *Explainable AI: Foundations, Applications, and Chal- lenges*. Wiley-Scrivener Publishing. ISBN-13: 978-1119786202

**E-RESOURCES**

Dive into Deep Learning:Aston Zhang, Zachary C. Lipton, Mu Li, And Alexander J.Smola.(2024). *Dive into Deep Learning*Paperback. ISBN 1009389432. link- https://d2l.ai/d2l-en.pdf

https://developer.nvidia.com/deep-learning

https://builtin.com/machine-learning/deep-learning

https://www.deeplearningbook.org/

https://www.ibm.com/topics/explainable-ai

https://research.ibm.com/topics/quantum-machine-learning

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | CLOUD NATIVE APPLICATION DEVELOPMENT |
| | COURSE CODE | 2304328T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : 01/07/2025 | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Data Structures, Database Management Systems, Cloud Computing Foundations

**COURSE OBJECTIVES :**

2304328T.CEO.1: To understand how to program various AWS services using SDK 2304328T.CEO.2: To decide the selection of various database services provided by AWS 2304328T.CEO.3: To learn the concept of Infrastructure as a Code

2304328T.CEO.4: To develop the server less applications

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304328T.CO.1: To choose between server based and serverless services to deploy the application on cloud platform [L3]

2304328T.CO.2: To make use of SDKs to programmatically access the AWS Services [L3] 2304328T.CO.3: To distinguish between protocols for developing own API [L4]

2304328T.CO.4: To select an appropriate configuration for provisioning infrastructure as a code [L5] 2304328T.CO.5: To develop and deploy a web application using various cloud services [L6]

**COURSE ABSTRACT:**

The cloud has transformed our lives as individuals as well. Many of us use cloud services every day. When we update our status on social media, binge a new streaming series, or check our bank accounts we're most likely using applications that are hosted by cloud services. These apps are accessed through an internet connection rather than installed on our hard drives or devices.

The main objective of this course is to learn application development using Amazon AWS cloud provider. Finally, the students must develop an end to end application considering some user requirements by applying front-end and back-end technologies which will be deployed on AWS platform.

**THEORY COURSE CONTENT**

| | | |
|---|---|---|
| **UNIT 1** | **Programming AWS Services** | **7 HOURS** |

**App/System/Case study:** AWS EC2, Amazon S3, Amazon RDS, AWS DynamoDB, AWS IAM
**Contents:** IIntroduction to boto3 module for programming in Python Managing EC2 instances, IAM Operations, VPC Components using Python Programming with AWS RDS, AWS DynamoDB, AWS DocumentDB and AWS Elasticache in Python
**Self Study:** Programming AWS Services using JavaScript
**Further Reading:** AWS LaunchWizard

| | | |
|---|---|---|
| **UNIT 2** | **Provosioning Infrastructure Through Code** | **7 HOURS** |

**App/System/Case study:** Amazon CloudFormation
**Contents:** Cloud Formation concepts, How does Cloud Formation works, , Working with Stacks, Working with Templates, Working with StackSets, Using the Cloud Formation Registry, Logging API Calls, Infrastructure Security, Configuration and vulnerability analysis Infrastructure provisioning using Terraform
**Self Study:** AWS Lake Formation
**Further Reading:** ArgoCD

| | | |
|---|---|---|
| **UNIT 3** | **AWS Serverless** | **7 HOURS** |

**App/System/Case study:** AWS Lambda, AWS Step Functions
**Contents:** Need for Serverless architecture, How serverless architecture works Foundations of Lamdba Functions – concepts, features, programming model, architectures, function scaling, Lambda Permissions – Execution role, resource based policies, user policies, Configuration Functions, Managing Functions, Invoking Functions, lambda Functions AWS Step Functions Designing a workflow using AWS Step Functions.
**Self Study:** AWS Lake Formation
**Further Reading:** Writing AWS Lambda Functions in JavaScript

| UNIT 4 | API Development and Management in AWS | 7 HOURS |
|---|---|---|
| **App/System/Case study:** Amazon API Gateway<br>**Contents:** Understanding REST principles, Defining resources and methods<br>Overview of API Gateway - key features and benefits, creating an API using API Gateway Console, Configuring stages and deployments, Integrating with backend services - Lambda integration, integrat- ing with AWS Services like S3, DynamoDB, API Keys and usage plans, Caching in API Gateway **Self Study:** WebSocket API<br>**Further Reading:** Exporting API using OpenAPI Standards | | |
| **UNIT 5** | **Building CI/CD Pipelines on AWS** | **7 HOURS** |
| **App/System/Case study:** Amazon CodeCommit, Amazon CodeBuild, AWS CodeDeploy, AWS CodePipeline<br>**Contents:** What is CI/CD? CodePipeline concepts, How pipeline execution works, Integration with CodePipeline action types, working with pipelines, working with actions, working with stage transitions, monitoring pipelines, security in pipelines<br>AWS CodeCommit, AWS CodeBuild, AWS CodeDeploy<br>Introduction to Jenkins<br>**Self Study:** ClouWatch Events for Pipelines<br>**Further Reading:** Jenkins Pipelines | | |
| **UNIT 6** | **Advanced Topics in AWS Development** | **7 HOURS** |
| **App/System/Case study:** AWS CDK, AWS SAM, AWS Cognito, AWS XRay<br>**Contents:** AWS CDK - Overview, Benefits, Key concepts and terminology - constructs, stacks, apps, Supported programming languages, Launching resources using AWS CDK<br>AWS SAM - Introduction, key features, benefits, SAM template anatomy, Creating serverless functions, Building and deploying applications<br>Amazon Cognito - Introduction, User pools and identity pools, Adding social identity providers (like Facebook, Google, etc.) to the app<br>AWS X-Ray - Introduction, Setup, Instrumenting application code to generate trace data, Understand- ing trace data and segments, Visualizing trace data using AWS X-Ray console, Using X-Ray SDKs for various programming languages<br>**Self Study:** AWS Parameter Store<br>**Further Reading:** AWS Secrets Manager | | |

**TEXT BOOKS**

Wittig, Michael, Andreas Wittig, and Ben Whaley. (2015). Amazon web services in action. Manning, Dreamtech Press, ISBN:978-9351198758.

Murty, James. Programming amazon web services: S3, EC2, SQS, FPS, and SimpleDB. (2008). O'Reilly Media, Inc.", ISBN 978-0596515812.

Tankariya, Vipul, and Bhavin Parmar. (2019). AWS Certified Developer-Associate Guide: Your one-stop solution to pass the AWS developer's certification. 2nd Edition, Packt Publishing Ltd, ISBN 978-1789617313.

Alteen, Nick, et al. (2019). AWS Certified Developer Official Study Guide: Associate (DVA-C01) Exam. John Wiley Sons,

Van Vliet, Jurg, Flavia Paganelli, and Jasper Geurtsen. (2013). Resilience and Reliability on AWS: Engineering at Cloud Scale. O'Reilly Media, Inc.,

Sarkar, Aurobindo. (2018). Learning AWS: Design, build, and deploy responsive applications

**REFERENCE BOOKS**

Kavis, Michael J. (2014). Architecting the cloud: design decisions for cloud computing service models (SaaS, PaaS, and IaaS). John Wiley Sons, ISBN 978-1118617618.

Vacca, John R. (2020). Cloud computing security: foundations and challenges. 2nd Edition, CRC Press, ISBN. 978-0367560331.

Furht, Borivoje, and Armando Escalante. (2014). Handbook of cloud computing. Vol. 3. New York: springer. ISBN. 978-1489994561

**E-RESOURCES**

https://docs.aws.amazon.com/

https://www.workshops.aws/

https://www.terraform.io/

https://boto3.amazonaws.com/v1/documentation/api/latest/index.html

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Cloud Native Application Development Lab |
| | COURSE CODE | 2304328L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PRE-REQUISITE KNOWLEDGE :** Data Structures, Database Management Systems, Cloud Computing Foundations

**COURSE OBJECTIVES :**

2304328L.CEO.1: To understand how to program various AWS services using SDK 2304328L.CEO.2: To decide the selection of various database services provided by AWS 2304328L.CEO.3: To learn the concept of Infrastructure as a Code

2304328L.CEO.4: To develop the server less applications

**COURSE OUTCOMES:**

The students after completion of the course will be able to,

2304328L.CO.1: To model the program for accessing AWS Services programmatically [L3] 2304328L.CO.2: To build the API using various protocols [L4]

2304328L.CO.3: To choose an appropriate configuration for provisioning infrastructure as a code [L5] 2304328L.CO.4: To develop and deploy a web application using various cloud services [L6]

**COURSE ABSTRACT:**

The cloud has transformed our lives as individuals as well. Many of us use cloud services every day. When we update our status on social media, binge a new streaming series, or check our bank accounts we're most likely using applications that are hosted by cloud services. These apps are accessed through an internet connection rather than installed on our hard drives or devices.

The main objective of this course is to learn application development using Amazon AWS cloud provider. Finally, the students must develop an end to end application considering some user requirements by applying front-end and back-end technologies which will be deployed on AWS platform.

**PRACTICAL:**

| **PRACTICAL NO.01** | **Programming AWS Services in Python** | **6 HOURS** |
|---|---|---|

- Write a program in Python to count the number of running, stopped and terminated instances
- Write a program in Python to start all the stopped instances
- Write a program in Python to stop all the running instances
- Write a program in Python to implement various IAM operations
- Write a program in Python to create VPC components
- Write a program in Python to implement CRUD operations on RDS, DynamoDB tables, Elasti- cache
- Write a program in Python to implement various S3 operations

| PRACTICAL NO.02 | Provisioning Infrastructure Through Code | 6 HOURS |
|---|---|---|
| • Create a CloudFormation Template to create all the VPC Components and Launch an EC2 instance in the VPC created<br>• Implement the concept of changeset using CloudFormation<br>• Implement the concept of nested stacks using CloudFormation<br>• Create a Terraform Template to create all the VPC Components and Launch an EC2 instance in the VPC created | | |
| **PRACTICAL NO.03** | **Serverless Application Development** | **4 HOURS** |
| • Create a Lambda function to receive the details from S3 bucket and display those details<br>• Create a Lambda function to implement CRUD operations for DynamoDB | | |
| **PRACTICAL NO.04** | **API Development and Management in AWS** | **6 HOURS** |
| • Create a REST based API to implement CRUD Operations for DynamoDB<br>• Create a WebSocket API | | |
| **PRACTICAL NO.05** | **Building CI/CD Pipelines on AWS** | **6 HOURS** |
| • Implement CodeCommit for a sample web application<br>• Implement CodeBuild for a sample web application<br>• Implement Code Deploy for a sample web application | | |
| **PRACTICAL NO.06** | **Advanced Topics in AWS Development** | **8 HOURS** |
| • Create AWS SAM Template for creating a Lambda function<br>• Create AWS SAM Template for creating a Step Function<br>• Implement Identity Fedatation using AWS Cognito<br>• Integrate Lambda function with AWS X-Ray | | |
| **PRACTICAL NO.07** | **Project** | **8 HOURS** |
| Select a web application for deployment on AWS Infrastructure. Create an architecture diagram for the deployment. Launch an architecture by developing a template using CloudFormation / Terraform.<br>After the infrastructure is ready deploy the web application using CI/CD Pipeline | | |

**REFERENCE BOOKS**

Kavis, Michael J. (2014). Architecting the cloud: design decisions for cloud computing service models (SaaS, PaaS, and IaaS). John Wiley Sons, ISBN 978-1118617618.

Vacca, John R. (2020). Cloud computing security: foundations and challenges. 2nd Edition, CRC Press, ISBN. 978-0367560331.

Furht, Borivoje, and Armando Escalante. (2014). Handbook of cloud computing. Vol. 3. New York: springer, ISBN. 978-1489994561

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | CYBER SECURITY AND FORENSICS |
| | COURSE CODE | 2304329T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**COURSE OBJECTIVES :**

2304329T.CEO.1: To gain a fundamental knowledge of Cyber threats and Cyber vulnerabilities.

2304329T.CEO.2: To understand the security concerns in IoT devices.

2304329T.CEO.3: To implement a secure application and maintain integrity with the help of network security appliances.

2304329T.CEO.4: To ascertain the usefulness of Information and Enterprise security.

2304329T.CEO.5: To know about the forensic analysis and the investigation process.

2304329T.CEO.6: To use the forensics tools in an investigation process.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to

2304329T.CO.1: Outline different software bugs that pose security threats, and to attack a network. [L2]

2304329T.CO.2: Identify the issues and challenges in mobile applications and to discover the security vulnerabilities. [L3]

2304329T.CO.3: Wireless system design, system architecture and ensuring supportive applica- tions that can speed up all the processes. [L3].

2304329T.CO.4: Analyze the fundamental risk management principles and controlling IT operations to implement security guidelines for various types of Industries [L4].

2304329T.CO.5: Examine Forensics systems with respect to maintaining operations in the presence of risks and threats. [L4].

2304329T.CO.6: Evaluate with the help of Digital Forensic tools the security vulnerabilities in the systems [L5].

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Emerging Cyber Threats and Vulnerabilities** | **08 HOURS** |

**Applications/Case Study:** Network Security

**Contents:** Definition of Cybercrime, Classification of Cybercrimes, Cyber Attacks and Their Counter- measures, Behavioral Aspects of Cyber Security, Role of Cyber Security on Intelligent Transportation Systems, Necessity of Cryptography for Cybersecurity Applications, Application of Cyber Security for Cloud-based Applications.

| | | |
|---|---|---|
| **UNIT 2** | **IoT Security and Privacy** | **08 HOURS** |

**Applications/Case Study:** Display devices- OLEDs, Micro LEDs, Radar displays

**Contents:** Trends in Mobility, Security challenges posed by mobile devices, Service Orchestration and Routing for IoT, Privacy, Security, Trust, Identity, and Anonymity in IoT, Threats to mobile applications, analyzers for Mobile Applications to discover the security vulnerabilities, Security architecture in IoT, Android Security Architecture.

**Self Study:** Wireless system design, system architecture,

| | | |
|---|---|---|
| **UNIT 3** | **Infrastructure and Application Security** | **06 HOURS** |

**Applications/Case Study:** Design of different Applications

**Contents:** Device Security, Topologies and IDS, Authentication and Authorization, Session Man- agement, Control hijacking attacks – buffer overflow, integer overflow, bypassing browser memory protection, Privilege, access control and Operating System Security, Case Study: Security of E-mail System, Database Security basics.

**Self Study:** Firewall Implementation

| UNIT 4 | Information and Enterprise Security | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Enterprise Network

**Contents:** Definition, Terminologies, Goals of Information Security and Implementation issues, Access control- password, MFA, -, Security issues in Cloud Computing, Introduction to Enterprise Security, Planning and designing the Security Architecture, Security Architecture: Operations, Security Governance and Risk Management.

**Self Study:** E-mail System

| UNIT 5 | Digital Forensics | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Forensics Analysis

**Contents:** Overview of Digital Forensics, the sub disciplines, Digital Evidence, Forensics analysis of email, Digital Forensics Life Cycle, Chain of Custody concept, Network Forensics, Relevance of OSI Layers, Data Recovery and OS Forensics, Email Crimes and Violations, Case Study: The Investigation process, Setting up a laboratory.

**Self Study:** The methods of data acquisition.

| UNIT 6 | Digital Forensics Tools | 06 HOURS |
|---|---|---|

**Applications/Case Study:** How can a tool be used for forensic analysis

**Contents:** Best Practices, what makes a tool forensically sound, performing tool testing, Classes of Forensics tools.

**Self Study:** Implementation of any tool using kali Linux.

**TEXT BOOKS**

Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunit Belpure, Wiley India Edition.

Information Systems Security: Security Management, Metrics, Frameworks and best Practices by Nina Godbole Wiley India Edition

Cyber SECURITY Protecting Critical Infrastructures from Cyber Attack and Cyber Warfare, Thomas Johnson, CRC Press, taylor Franscis Group

Digital Forensics for Legal Professionals: Understanding Digital Evidence from the Warrant to the Courtroom, Larry Daniel, Lars Daniel

**REFERENCE BOOKS**

Security Architecture: Design, Deployment and Operations by Christopher King, Curtis Dalton, T.Ertem Osmanoglu

Information Security: Principles and Practices by Mark Merkow, Jim Breithaupt

Internet Security: A Jumpstart for Systems Administrators and IT managers by Tim Speed and Juanita Ellis

Web Hacking-Attacks and Defence by Stuart McClure, Saumil Shah, Shreeraj Shah

Computer Security Principles and Practices: William Stallings and Larry Brown Pearson edition

**E-RESOURCES**

1. https://nptel.ac.in/courses/106106248

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | CYBER SECURITY AND FORENSICS LAB |
| | COURSE CODE | 2304329L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** NIL

**COURSE OBJECTIVES :**

2304329L.CEO.1: To gain a fundamental knowledge of Cyber threats and Cyber vulnerabilities.

2304329L.CEO.2: To understand the security concerns in web based applications.

2304329L.CEO.3: To implement a secure framework to automate web application security assessment.

2304329L.CEO.4: To ascertain the usefulness of Open Source Intelligence tools.

2304329L.CEO.5: To know about the forensic analysis and the investigation process.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304329L.CO.1: Outline various security threats that can attack the network and the necessary pre- ventive measures implemented using the security policies [L2].

2304329L.CO.2: Identify the injection flaws and ensure website security [L3].

2304329L.CO.3: Develop a framework that can identify the bugs and ensure that the web applications security assessment is done automatically [L3].

2304329L.CO.4: Analyze the bruteforcing Web Applications to discover common vulnerabilities [L4].

2304329L.CO.5: Examine Forensics systems with respect to maintaining operations in the presence of risks and threats. [L4].

| PRACTICALS | | |
|---|---|---|
| PRACTICAL NO.01 | A. Study of the features of NSA in providing network security and to set Firewall with proper configuration. B. Configure Security parameters in any one web browser C. Study of different types of vulnerabilities for hacking a websites / Web Applications. | 4 HOURS |
| | | |
| PRACTICAL NO.02 | Implement a penetration testing tool that automates the process of detecting and exploiting SQL injection flaws and taking over of database servers. | 4 HOURS |
| | | |
| PRACTICAL NO.03 | Install Kali Linux and utilize various security tools for defense of the system. | 4 HOURS |
| | | |
| PRACTICAL NO.04 | Implement a framework to automate web applications security assessments and could help you to secure your web applications by finding and exploiting web application vulnerabilities. | 4 HOURS |
| | | |
| PRACTICAL NO.05 | Implement wfuzz to discover common vulnerabilities in web applications through the method of fuzzing. | 2 HOURS |
| | | |
| PRACTICAL NO.06 | Using an OSINT Tool like Shodan or Censys, find out the details about the servers, networks; and internet connected devices. | 4 HOURS |
| | | |
| PRACTICAL NO.07 | PWN till Dawn lab offensive security | 2 HOURS |
| | | |
| PRACTICAL NO.08 | Configure Wireless Access Point and provide MAC based security. A. Analyze wifi traffic. B. Cracking into WEP, WPA2 C. Evil twin attack with fake access point | 4 HOURS |
| | | |

**COURSE OBJECTIVES :**

2304366L.CEO.1: To configuring, installing, and upgrading Linux systems using established standards and procedures.

2304366L.CEO.2: To understand security policies using SELinux . 2304366L.CEO.3: To understand filesystems ,partitioning,Logical volume

2304366L.CEO.4: Gain sufficient skill to perform advance system administration tasks on Red Hat Enterprise Linux

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **DEPARTMENT OF ARTIFICIAL INTELLIGENCE** | **W.E.F** | **AY:** |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Linux Administration -II |
| | **COURSE CODE** | 2304366L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE :** | **REVISION NO.** | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** Fundamental of Linux operating system, Operating system

| PRACTICALS | | |
|---|---|---|
| PRACTICAL NO.01 | Improving Command-line Productivity:Writing Simple Bash Scripts,Running Commands More Efficiently Using Loops,Matching Text in Command Output with Regular Expressions | 4 HOURS |
| PRACTICAL NO.02 | Scheduling Future Tasks,Scheduling a Deferred User Job,Scheduling Recurring User Jobs,Scheduling Re- curring System Jobs,Managing Temporary Files | 4 HOURS |
| PRACTICAL NO.03 | Tuning System Performance: Adjusting Tuning Profiles,Influencing Process Scheduling | 4 HOURS |
| PRACTICAL NO.04 | Controlling Access to Files with ACLs,Interpreting File ACLs,Securing Files with ACLs | 4 HOURS |
| PRACTICAL NO.05 | Managing SELinux Security: Changing the SELinux Enforcement Mode,Controlling SELinux File Contexts,Adjusting SELinux Policy with Booleans, Investigating and Resolving SELinux Issues | 6 HOURS |
| PRACTICAL NO.06 | Managing Basic Storage:Adding Partitions, File Systems, and Persistent Mounts,Managing Swap Space | 6 HOURS |
| PRACTICAL NO.07 | Managing Logical Volumes,Creating Logical Volumes,Extending Logical Volumes | 4 HOURS |
| PRACTICAL NO.08 | Implementing Advanced Storage Features:Mounting Network-Attached Storage with NFS,Automounting Network-Attached Storage | 4 HOURS |
| PRACTICAL NO.09 | Accessing Network-Attached Storage: Mounting Network-Attached Storage with NFS,Automounting Network-Attached Storage | 4 HOURS |
| PRACTICAL NO.10 | Controlling the Boot Process:Selecting the Boot Target,Resetting the Root Password,Repairing File System Issues at Boot,Repairing File System Issues at Boot | 6 HOURS |
| PRACTICAL NO.11 | Managing Network Security:Managing Server Firewalls,Controlling SELinux Port Labeling | 6 HOURS |

| | | |
|---|---|---|
| **PRACTICAL NO.12** | **IRunning Containers,Introducing Containers,Running a Basic Container, Finding and Managing Container Images,Performing Advanced Container Management, Attaching Persistent Storage to a Container,Managing Containers as Services.** | **6 HOURS** |
| **PRACTICAL NO.13** | **Installing Red Hat Enterprise Linux: Installing Red Hat Enterprise Linux, Automating Installation with Kickstart,Installing and Configuring Virtual Machines** | **2 HOURS** |

**TEXT BOOKS**

1. Red Hat Enterprise Linux 9.0, ”RH134: RED HAT SYSTEM ADMINISTRATION I”, Student Guide

**REFERENCE BOOKS**

1. Red Hat Enterprise Linux 8.2, ”RH134: RED HAT SYSTEM ADMINISTRATION II”, Student Guide

**E-RESOURCES**

1. https://rha.ole.redhat.com/rha/app/courses/rh124

| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
|---|---|---|
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | CLOUD SERVICES |
| | COURSE CODE | 2304367L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE KNOWLEDGE :** Cloud Computing Foundations

**COURSE OBJECTIVES :**

2304367L.CEO.1: Identify global infrastructure components of AWS. 2304367L.CEO.2: Differentiate between Amazon S3, EBS, EFS, S3 Glacier.

2304367L.CEO.3: Explore key concepts to Elastic Load Balancing, Amazon CloudWatch, EC2.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304367L.CO.1: Define different types of cloud computing models and Services and Services Categories [L2].

2304367L.CO.2: Create own VPC and add additional components to produce customized network [L6].

2304367L.CO.3: Demonstrate AWS Elastic Beanstalk, AWS Lambda [L4].

2304367L.CO.4: Perform tasks in Amazon RDS database such as launching, configuring and interacting. [L3].

2304367L.CO.5: Configure different types of security monitoring AWS Architectures [L5].

**COURSE ABSTRACT:**

Amazon Web Services offers a broad set of global cloud-based products including compute, storage, databases, analytics, networking, mobile, developer tools, management tools, IoT, security, and enter- prise applications: on-demand, available in seconds, with pay-as-you-go pricing. From data warehousing to deployment tools, directories to content delivery, over 200 AWS services are available. Learning AWS can help students land a job in the cloud domain, increase their salary, and advance their career. Learn- ing is beneficial for both beginners and intermediate AWS developers with a few years of experience. Students can take up an AWS certification to learn about AWS and build in-demand cloud skills.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **AWS Global Infrastructure** | **6 HOURS** |
| a) Identify the difference between AWS Regions, Availability Zones and edge locations<br>b) Identify AWS services Service categories. | | |
| **PRACTICAL NO.02** | **Network and Content Delivery.** | **6 HOURS** |
| a) Study three fundamental AWS networking and content delivery services: Amazon Virtual Private Cloud (Amazon VPC), Amazon Route 53, and Amazon CloudFront.<br>b) Label a virtual private cloud (VPC) network architecture diagram<br>c) Design a VPC, watch how a VPC is built, and build a VPC. | | |
| **PRACTICAL NO.03** | **Databases** | **8 HOURS** |
| a) Introduction to four of the most commonly used AWS database services:<br>Amazon Relational Database Service (Amazon RDS) Amazon DynamoDB Amazon Redshift Amazon Aurora<br>b) Perform tasks in an Amazon RDS database such as launching, configuring, and interacting. | | |
| **PRACTICAL NO.04** | **Cloud Architectures.** | **6 HOURS** |
| a) Describe the AWS Well-Architected Framework<br>b) Identify the design principles of the AWS Well- Architected Framework<br>c) Explain the importance of reliability and high availability<br>d) Identify how AWS Trusted Advisor helps customers and Interpret AWS Trusted Advisor recommen- dations | | |
| **PRACTICAL NO.05** | **AWS EC2 Load Balancing** | **8 HOURS** |

a) Study of three fundamental AWS services Elastic Load Balancing Amazon Elastic Compute Cloud (Amazon EC2) Auto Scaling Amazon CloudWatch

b) Build dynamic, scalable architectures.

c) Indicate how to distribute traffic across Amazon EC2 instances by sing Elastic Load Balancing

| **PRACTICAL NO.06** | **AWS Auto Scaling .** | **6 HOURS** |
|---|---|---|

a) Identify how Amazon Cloud Watch enables you to monitor AWS resources and applications in real time

b) Explain how Amazon EC2 Auto Scaling launches and releases servers in response to workload changes.

c) Perform scaling and load balancing tasks to improve an architecture

| **PRACTICAL NO.07** | **AWS Cloud Security .** | **8 HOURS** |
|---|---|---|

a) Introduction to the AWS approach to security, controls in the AWS environment

b) Describe different types of security credentials in IAM.

c) Securing a new AWS account, Explore IAM users and groups. Secure AWS data with different methods.

| **PRACTICAL NO.08** | **Availability and Monitoring .** | **8 HOURS** |
|---|---|---|

a) Designing an Environment that's Highly Available

b) Creating high available web application

c) Monitoring AWS Architecture using Cloud Watch Cloud Trail, Guard Duty

**TEXT BOOKS**

Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1st Edition

Anthony T. Velte Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, 2010, the McGraw-Hill.

**REFERENCE BOOKS**

Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.

Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Cloud Computing Black Book ,Wiley Dreamtech,ISBN:9789351194187

Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN: 9789380853772

**E-RESOURCES**

aws.amazon.com/training

AWS Academy Educator

https://eduskillsfoundation.org/index.php/aws-academy/

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Practitioner's Approach to AI |
| | COURSE CODE | 2304368L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : 01/07/2023 | REVISION NO. | 0.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**COURSE OBJECTIVES :**

2304368L.CEO.1: To Organize raw data of dataset to improve model performance. 2304368L.CEO.2: To Develop critical thinking skills by solving real-world problems. 2304368L.CEO.3: To Fine-tune hyper-parameters to optimize learning models.
2304368L.CEO.4: To Select learning techniques to solve computer vision and Natural Language Pro- cessing Problems.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304368L.CO.1: Implement data preprocessing techniques to improve model performance. [L3]
2304368L.CO.2: Apply different learning Models for evaluation of the strengths and limitations for defined real world problem [L3]
2304368L.CO.3: Analyze the optimal configuration of hyperparameters for enhancing the learning mod- els. [L3]
2304368L.CO.4: Compare the learning algorithms, assessing performance, strengths, and weaknesses comprehensively. [L4]

**COURSE ABSTRACT:**

Practitioner's approach to AI delves into the cutting-edge domain of Artificial Intelligence. In today's rapidly evolving technological landscape, the practical application of Artificial Intelligence (AI) is becom- ing increasingly prevalent across industries. This comprehensive course is designed to equip practitioners with the knowledge, skills, and tools necessary to leverage AI technologies effectively in real-world sce- narios.The course begins by providing a solid theoretical foundation in AI, covering key concepts such as machine learning algorithms, neural networks, and deep learning architectures. However, the pri- mary focus lies on bridging the gap between theory and application, empowering participants to tackle practical AI challenges with confidence.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Implementation of Knowledge based Systems.** | **4 HOURS** |
| a) Develop Vacuum Cleaner Agent Application. b) Develop an knowledge base system consisting of facts and rules about some specialized knowledge domain of your choice. | | |
| **PRACTICAL NO.02** | **Implement searching Algorithms using AI.** | **4 HOURS** |
| Find the shortest path for any particular source and destination using A* Algorithm. | | |
| **PRACTICAL NO.03** | **Analyse the performance of Regression Models for a given Application.** | **6 HOURS** |
| Data Preparation and Model Implementation<br>. Select suitable dataset with continuous target variables.<br>. Preprocess data, handle missing values, and encode categorical features. Model Design and Imple- mentation.<br>. Linear regression, Logistic Regression, Multi Variate Regression Model Training and Evaluation.<br>. Split dataset into training and testing sets.<br>. Train each model on training set.<br>. Evaluate models using appropriate metrics(MSE,RMSE,R2)<br>. Comparative Analysis<br>. Compare performance of various regression techniques.<br>.Analyze strengths, weaknesses, interpretability, computational efficiency, and model complexity. Con- clusion<br>. Summarize findings, provide recommendations, and discuss improvement areas<br>. | | |

| PRACTICAL NO.04 | **Implement and compare different classification algo- rithms.** | **6 HOURS** |
|---|---|---|
| Data Preprocessing: Prepare the dataset by handling missing values, encoding categorical variables, and scaling features.<br>Model Implementation: Develop classification models using Naive Bayes, KNN,SVM and Decision Trees (CART)<br>Training and Evaluation: Train each model on a portion of the dataset and evaluate their performance using relevant metrics (accuracy, precision, recall, F1-score,loss).<br>Comparative Analysis: Compare the results obtained from each algorithm to identify patterns and differences.<br>Conclusion: Summarize the findings and discuss the suitability of each algorithm for various classifi- cation tasks. | | |
| **PRACTICAL NO.05** | **Implement and Analyse the effect of Ensemble Learn- ing in Classification** | **4 HOURS** |
| Dataset Selection and Preprocessing:Preprocess images from selected dataset for resizing, normaliza- tion, and data augmentation.<br>Stacking: Implement a stacking ensemble using a meta-classifier to combine predictions from base classifiers.<br>AdaBoost: Implement an AdaBoost ensemble using chosen base classifiers. Voting: Implement a voting ensemble that combines the predictions of the base classifiers through majority voting.<br>Model Comparison: Compare the performance of the ensemble models using appropriate classification metrics.<br>Analysis and Interpretation: Analyze the strengths and weaknesses of each ensemble method, explore scenarios where one method may outperform the others, and discuss the impact of diversity among base classifiers on ensemble performance.<br>Conclusion: Summarize the findings, provide insights into when to use each ensemble method, and suggest potential areas for further research or improvement. | | |

| PRACTICAL NO.06 | Design , Implement, and Evaluate Neural Networks for Classification. | 4 HOURS |
|---|---|---|
| ata set preprocessing<br>Neural Network Architecture Design:Create image classification neural network; choose activations, loss, and optimizers.<br>Model Implementation:Implement the neural network framework for data loading, model training, and evaluation.<br>Training the Neural Network:Separate data into training and testing, track loss and accuracy. Model Evaluation: Assess model on test set, compute metrics, and visualize confusion.<br>Hyperparameter Tuning:Explore the impact of hyperparameters on model performance. Conclusion and Reflection: Summarize results and discuss model performance. | | |
| **PRACTICAL NO.07** | **Implement suitable application using Pre-trained Convolutional Neural Network for Image Classification** | **6 HOURS** |
| Choose a relevant dataset for image classification.<br>Select a pre-trained CNN model that suits the dataset's nature.<br>Prepare the dataset for training, perform data augmentation, normalization, and preprocessing. Load the pre-trained CNN model and modify the final layers for the specific classification task. Train the modified CNN on the dataset using transfer learning techniques.<br>Evaluate the performance of the fine-tuned model on a separate validation set. Visualize the model's predictions on sample images from the validation set.<br>Compare the fine-tuned model with a baseline model.<br>Experiment with hyperparameter tuning and optimization strategies to improve the model's perfor- mance. | | |
| **PRACTICAL NO.08** | **Design the model for Object Detection, Segmentation, and Recognition Using Deep Learning.** | **4 HOURS** |

| |
|---|
| Select a dataset with annotations for object detection, segmentation masks, and class labels. Preprocess the dataset for training, including image resizing, normalizing pixel values, and handling annotations.<br>Design a deep learning model architecture for object detection, segmentation, and recognition. Train the model and implement multi-task learning.<br>Experiment with hyper-parameter values and optimize parameters. Evaluate the model on a separate test dataset.<br>Fine-tune the model using transfer learning.<br>Implement optimization techniques for object detection and segmentation. Create visualizations of model predictions.<br>Discuss challenges and potential real-world applications. |

| | | |
|---|---|---|
| **PRACTICAL NO.09** | **Implement and Analyse the performance of different Machine Learning Algorithms for Sentiment Analysis on Review.** | **4 HOURS** |
| Data Acquisition and Preprocessing: Obtain dataset with sentiment labels.Perform data cleaning, re- move stopwords, punctuation, irrelevant information. Visualize sentiment distribution in dataset.<br>Text Representation: Convert the preprocessed text data into numerical vectors using techniques such as TF-IDF (Term Frequency-Inverse Document Frequency) or word embeddings like Word2Vec , GloVe. Model Development: Implement a baseline sentiment analysis model using a machine learning algo- rithm (e.g., Logistic Regression or Naive Bayes).<br>Model Training and Evaluation:Divide the dataset into training and testing sets, train both baseline and advanced models on the training set, and evaluate the models on the testing set using metrics.<br>Conclusion:Summarize Key findings and insights are summarized, along with recommendations for im- proving model performance and addressing challenges, and suggestions for future research in NLP and sentiment analysis. | | |
| **PRACTICAL NO.10** | **Implement and Analyse deep sequence models for se- quence classification.** | **4 HOURS** |

Select relevant NLP datasets like sentiment analysis, text classification, named entity recognition, or machine translation.
Perform data preprocessing tasks like tokenization, padding, and embedding.
Design sequence model's architecture specifying layers, recurrent layers, and activation functions. Train the sequence model on the selected NLP dataset.
Experiment with hyperparameter values for improved performance. Choose appropriate evaluation metrics for the selected NLP task. Evaluate the trained sequence model on a separate test dataset.
Discuss challenges and considerations during training and evaluation.
Summarize results, discuss strengths and limitations, and provide insights into improvements.

| PRACTICAL NO.11 | **Implement deep sequece models for sequence gener- ation.** | **4 HOURS** |
|---|---|---|

Select a deep learning framework and Seq2seq model suitable for NLP tasks. Select a relevant dataset relevant to a Seq2seq NLP task.
Perform data preprocessing tasks such as tokenization, padding, and embedding.
Design encoder and decoder architecture, attention mechanism, and activation functions. Train and Experiment with hyperparameter values for improved performance.
Select appropriate evaluation metrics for the selected seq2seq NLP task and compare the model's performance with baseline models or traditional NLP approaches.
Implement optimization techniques to improve the stability and convergence of the seq2seq model. Summarize the results, discuss strengths and limitations, and provide insights into potential improve- ments.

| PRACTICAL NO.12 | **Implement Image Synthesis using GAN.** | **4 HOURS** |
|---|---|---|

Setup of TensorFlow and Keras, providing a starter code template.
Dataset Loading, Generator Model, Discriminator Model, and GAN Model.
Compilation of generator, discriminator, and GAN models with appropriate loss functions and opti- mizers.
Training Loop, Evaluation and Visualization, Experimentation, Results and Discussion.

| MINI PROJECTS | | 10 HOURS |
|---|---|---|

Implement a mini project making use of the concepts of Machine Learning algorithms, Deep Neural Networks for any of the application domain like computer vision, Matural Language processing.

**TEXT BOOKS**

1. Stuart Russell and Peter Norvig. (2016). Artificial Intelligence: A Modern Approach", Pearson, ISBN: 978-0134610993.

2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville. (2016).Deep Learning". The MIT Press,ISBN: 978-0262035613.

3. Christopher M. Bishop. (2006). Pattern Recognition and Machine Learning", Springer, ISBN: 978-0387310732.

**REFERENCE BOOKS**

Kevin P. (2012). Murphy,"Machine Learning: A Probabilistic Perspective", ISBN: 978-0262018029,Publisher: MIT Press.

Andreas Muller. (2016). "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly; ISBN: 978-9352134571

Prateek Joshi. (2016)."Python Machine Learning. Packt Publishing Limited. ISBN-13:978-8120337312

Rajalingappaa Shanmugamani.(2018). "Deep Learning for Computer Vision", Packt Publishing, ISBN: 978-1788295628.

Aurelien Geron. (2019). "Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor-Flow", O'Reilly Media, ISBN: 978-1492032649.

Maxim Lapan. (2018). "Deep Reinforcement Learning Hands-On", Packt Publishing, ISBN: 978-1788834247.

Seth Weidman, (2019). "Deep Learning from Scratch" Publisher: O'Reilly Media, ISBN: 978-1492045113

**E-RESOURCES**

https://developer.nvidia.com/deep-learning

https://builtin.com/machine-learning/deep-learning

https://www.deeplearningbook.org/

**TEXT BOOKS**

Prashanth K R, Darshan P R, Archana K (2023). *DOTNET Programming Using C#*. 1st Edition, Bluerose Publishers Pvt. Ltd. ISBN 9789358194333.

Grover Damini (2011) . *Dot Net Technology* . 2011 Edition, I K International Publishing House Pvt. Ltd ISBN:9789381141342.

**REFERENCE BOOKS**

Herbert Schildt (2010). *C# 4.0 The Complete Reference*. 13th Edition, McGraw-Hill, ISBN: 978-0071741163.

Kris HermansKris Hermans (2023). *C# 4.0 Mastering .Dot Net Framework: A Comprehensive Guide To Master The .Dot Net Framework*. 1st Edition, Cybellium Ltd.

Thuan L. Thai, Hoang Lam (2022). *.NET Framework Essentials Introducing the .NET Framework*. 3rd Edition, O'Reilly Media.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY<br>DEPARTMENT OF ARTIFICIAL INTELLIGENCE | COURSE NAME | Web and Desktop Application Development |
| | COURSE CODE | 2304369L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : 01/07/2025 | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**COURSE OBJECTIVES :**

2304369L.CEO.1: To make understand DotNet Framework, Components, Visual Studio Software In- stallation and the different languages supported in DotNet.

2304369L.CEO.2: To implement C# program structure.

2304369L.CEO.3: To explore the Windows Forms, Namespace, execution of Windows Form, available tools and their events.

2304369L.CEO.4: To provide fundamentals of ADO.NET Architecture with its API, available classes and objects in API.

2304369L.CEO.5: To apply the need of Collections and Assemblies in the DotNet Programming.

2304369L.CEO.6: To implement ASP.NET MVC Architecture for web applications designing.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304369L.CO.1: Implement object-oriented programming in C# [L3]. 2304369L.CO.2: Demonstrate application development with C# basic constructs[L3]. 2304369L.CO.3: Design windows forms for different applications using C# [L6].

2304369L.CO.4: Use Entity Framework to work with relational databases for connecting with C# and ASP.NET applications[L3].

2304369L.CO.5: Develop web applications using a combination of client-side and server-side technolo- gies to build multi-tier application[L6].

**COURSE ABSTRACT:**

The Web and Desktop Application Development course offers a comprehensive exploration of funda- mental concepts and practical applications of DotNet Programming. Beginning with C# basics and Object-Oriented Programming (OOPs), students delve into advanced topics such as Windows Form designing, ADO.NET for database connectivity, and mastering Collections and Assemblies. The cur- riculum culminates in a thorough understanding of ASP.NET for web development. Throughout the course, students engage in hands-on learning experiences, including a mini-project where they apply their skills to solve real-world problems by designing softwares and web applications. By the end, stu- dents emerge proficient in .NET development, equipped with the knowledge and skills to tackle diverse software engineering challenges.

**PRACTICALS**

| **PRACTICAL NO.01** | **Getting Started with DotNet and Introduction to C#** | **6 HOURS** |
|---|---|---|

Contents to be taught: Introduction to DotNet Framework, DotNet Versions, Visual Studio Versions, Installation, Features of Visual Studio IDE, Creating Project, Solution Using Visual Studio IDE, C# language basics (Syntax, data types, operators).
Practical Statement:

(a) Install Visual Studio and create a simple ”Hello World” console application.

(b) Write a program to demonstrate C# keywords like class, namespace, static, etc.

(c) Write a program to demonstrate C# data types like int, double, string, etc.

(d) Write a program to demonstrate C# operators like arithmetic, relational, logical etc.

(e) Write a program that takes user input and makes a decision based on if-else and switch conditional statements

| **PRACTICAL NO.02** | **OOPs using C# and Exception Handling** | **8 HOURS** |
|---|---|---|

Contents to be taught: Object-Oriented Programming concepts in C# (Classes, Objects, Methods, Inheritance, Polymorphism), Exception Handling. Practical Statement:

(a) Write a program to print numbers from 1 to 100 using a for loop and while loop

(b) Write a program to reverse a string using for/while loop

(c) Write a program to simulate a simple calculator using switch case

(d) Write a program to demonstrate class, objects, access modifiers

(e) Write a program to show inheritance using base and derived classes and also implement encap- sulation using getters and setters

| PRACTICAL NO.03 | Collections and Assemblies | 6 HOURS |
|---|---|---|

Contents to be taught: Collections (Lists, Dictionaries), Assemblies (Types, Creation, Usage). Practical Statement:

(a) Implement a C# console application that utilizes a collection (e.g., List, Dictionary) to store and manage a list of student records, including their names and grades.

(b) Create a C# class library project containing reusable components for mathematical operations (e.g., addition, subtraction, multiplication). Compile the library into an assembly and demon- strate its usage in multiple C# applications.

(c) Develop a C# program that reads a text file containing a list of words and stores them in a collection. Implement functionality to count the occurrences of each word and display the results in descending order of frequency.

(d) Build a C# application that utilizes a custom assembly containing encryption and decryption methods. Implement functionality to encrypt sensitive data input by the user and decrypt it for display.

| PRACTICAL NO.04 | Windows Forms using C# | 8 HOURS |
|---|---|---|

Contents to be taught: Creating Windows Forms Applications, Working with Controls (Labels, Textboxes, Buttons, etc.), Handling Events, Windows form deployment.
Practical Statement:

(a) Design Student Registrations Windows Form

(b) Design Unit Converter App with for various parameter (temp, length, etc)

(c) Design Simple Calculator App consider all basics operations.

| PRACTICAL NO.05 | ASP.NET MVC Architecture and Introduction | 10 HOURS |
|---|---|---|

Contents to be taught: Introduction to ASP.NET, First MVC Application, Understanding project structure, URL Routing, Introducing URL Patterns ,Creating and Registering a Simple Route, Razor Basic, Implementation of Razor, Razor Markup, View Data, Creating Forms, submit forms using view data, Adding different ASP.net components on pages.
Practical Statement:

(a) Develop a web page for managing products in an online store.

(b) Design a web application for tracking student grades.

(c) Develop an employee directory web application for a company.

| **PRACTICAL NO.06** | **ADO.NET** | **8 HOURS** |
|---|---|---|

Contents to be taught: ADO.NET Architecture, Database Connectivity with windows form and ASP.NET application, Basic CRUD operations, Navigation of data in data objects using Disconnection oriented model with SqlDataAdapter DataSet, DataTable, etc.
Practical Statement:

(a) Implement a C# console application that connects to a SQL Server database using ADO.NET. Allow the user to perform basic CRUD operations (Create, Read, Update, Delete) on a table of their choice.

(b) Create an ASP.NET web application that utilizes ADO.NET to connect to a SQL Server database. Develop a page where users can input data into a form and submit it to be stored in the database. Include validation for user input.

| **PRACTICAL NO.07** | **ASP.NET Development and Deployment Teaching** | **10 HOURS** |
|---|---|---|

Contents to be taught: Creating Forms, submit forms using view data, Adding different ASP.net components on pages, Authentication using Microsoft Identity, Creating a ASP.net web application with database and all CRUD operations, Areas in MVC 5 ,Filters in MVC5 ,Authorization Filter , Action Filter,Result Filter ,Exception Filter, Deployment of web application on the cloud.

Practical Statement:

(a) Create an ASP.NET web application featuring a user registration form. Utilize ADO.NET to connect to a SQL Server database and implement functionality to insert user information (e.g., username, email, password) into the database upon form submission. Include validation for required fields and email format.

(b) Develop a web page for managing products in an online store. Implement CRUD operations (Create, Read, Update, Delete) using ADO.NET to interact with a SQL Server database. Allow users to add new products, view existing products, update product details, and delete products from the database.

(c) Design a web application for tracking student grades. Create a page where teachers can input student grades for different subjects. Use ADO.NET to store and retrieve grade information from a SQL Server database. Implement features to calculate and display average grades for each student.

| | | |
|---|---|---|
| **MINI PROJECTS** | | **4 HOURS** |

**TEXT BOOKS**

Prashanth K R, Darshan P R, Archana K (2023). *DOTNET Programming Using C#*. 1st Edition, Bluerose Publishers Pvt. Ltd. ISBN 9789358194333.

Grover Damini (2011) . *Dot Net Technology* . 2011 Edition, I K International Publishing House Pvt. Ltd ISBN:9789381141342.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF HUMANITIES AND ENGINEERING SCIENCES | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Employability and Career Development |
| | COURSE CODE | 2301371L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : 01/07/2025 | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PRE-REQUISITE KNOWLEDGE :** Communication Skills, Universal Human Values-II.

**COURSE OBJECTIVES :**

2301371L.CEO.1: To define the importance of Employability skills in students life. 2301371L.CEO.2: To explain them necessary, specific Employability Career Development skills. 2301371L.CEO.3: To appraise students for placements through acquisition of professional skills.

2301371L.CEO.4: To support them detect their present level in respect of each Career Development skill and show direction for improvement..

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2301371L.CO.1: Relate the importance of Employability Career Development [L2]. 2301371L.CO.2: Build necessary, specific professional skills [L3].

2301371L.CO.3: Analyze the environment of employability [L4].

2301371L.CO.4: Develop various techniques of effective team building in their professional life [L6].

**COURSE ABSTRACT:**

The Employability and Career Development course is designed to enhance students' career readiness and personal growth through practical exercises focused on key aspects of professional development. The course covers self-management skills such as time management and goal setting, essential for personal productivity. Students will engage in personal interviews and group discussions to strengthen their communication abilities and public speaking confidence. Team building and motivational practices are explored to foster collaboration and a positive work environment. Innovative thinking is emphasized to cultivate creativity and adaptability in problem-solving. Additionally, students will learn profile development strategies, including crafting impactful resumes and LinkedIn profiles to enhance their professional online presence. By incorporating aptitude training and a focus on employability, the course aims to equip students with the necessary skills and mindset for success in their careers.

| **SECTION A: Personal Development with the help of Professionals (25 Marks)** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Self Management** | **4 HOURS** |
| Concept of Johari Window,Advantages and disadvantages of every quadrant,Identifying the proportion of each quadrant in respect of self, Using the tools of self-evaluation, self-development and Goal Setting, Stress management, Career anchor. | | |
| **PRACTICAL NO.02** | **Personal Interviews** | **4 HOURS** |
| Preparing for Interviews, Typical expected questions suggested responses, Posture, Body language, Greetings and pleasantries, , Handling unforeseen questions. | | |
| **PRACTICAL NO.03** | **Group Discussion and Public Speaking** | **4 HOURS** |
| Parameters of assessment,Initiating the discussion,Effective listening,Own contribu-tion,Paraphrasing,Arguing and counter-arguing, Giving direction to the discussion, Public Speaking skills. | | |
| **PRACTICAL NO.04** | **Team Building and Motivation** | **4 HOURS** |
| Hallmark of effective teams, Barriers to teamwork, Subjugation of Individual interests for achievement of teams goal, Leading motivating team members. | | |
| **PRACTICAL NO.05** | **Innovative Thinking** | **4 HOURS** |
| Relevance and importance of innovative thinking, Introduction to Brain Storming technique,Collective and individual Brain Storming. | | |
| **PRACTICAL NO.06** | **Profile Development** | **6 HOURS** |
| Resume Writing: Introduction to the Resume, Key Components of a Resume and Cover Letter, En- hancing tips for Resume and Cover Letter.<br>Letter of recommendation (LOR) preparation: Details on types, samples, structure, content tips format for letters of recommendation for student.<br>Statement of Purpose (SOP) preparation: SOP Formats, Templates, and Guidelines for SOP Writing. Job application and professional email writing. | | |

| SECTION B: | Aptitude Training from Video Based Content and Assessment Platform. (25 Marks) | 30 HOURS |
|---|---|---|
| 1. Number System<br>2. HCF LCM , Surds and Indices.<br>3. Percentages and Average.<br>4. Time and work.<br>5. Time, Speed and Distace.<br>6. Probability.<br>7. Quadratic Equations.<br>8. Profit and Loss.<br>9. Simple and Compound Interest.<br>10. Ratio and proportion.<br>11. Permutation and Combination.<br>12. Boats and Streams, Pipes and Cisterns.<br>13. Mixtures and Allegations, Mensuration.<br>14. Data Interpretation – Tables, Pie Charts, Bar Graphs, Line Graphs. | | |
| SECTION C: | Final Assessment with the help of career Assessment Test (25 marks) | 2 HOURS |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE SYLLABUS** | |
|---|---|---|
| **DEPARTMENT OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2026-2027 (Rev. 2023(NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Major Project - II |
| | **COURSE CODE** | 2304392L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : 01/07/2025** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304392.CO.1: Demonstrate proficiency in implementing engineering designs, utilizing modern tools, techniques, and technologies to bring their solutions to fruition [L4].

2304392.CO.2: Conduct rigorous testing and evaluation of implemented solutions, analyzing perfor- mance data to ensure that the solutions meet specified requirements and quality stan- dards [L5].

2304392.CO.3: Incorporate ethical considerations and sustainable practices into their implementation processes, evaluating the societal and environmental impacts of their solutions [L3].

2304392.CO.4: Work effectively in multidisciplinary teams, demonstrating strong collaboration, lead- ership, and project management skills throughout the implementation phases [L3].

**GUIDELINES**

1. Preferably project group students of Sem V would be continued in this semester VI.
2. Every project group should consist of minimum 03 and maximum of 04 students.
3. The group members may be from different programs to support the interdisciplinary functioning.
4. Project group members and title of the project need to be approved by Project Guide and DEPARTMENT .
5. Projects should preferably have a national/international, industry/academic/research collabora- tion.
6. User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
7. The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.
8. Define proposed solution and apply project management/modeling tools for project planning and design.
9. Define outcome, milestones, definite roadmap for project design, implementation, tools, resources, performance evaluation and documentation.
10. Perform refinement of System architecture & methodology.
11. Students should give a mature shape to their idea in terms of implementation. This is expected in this semester. This may include one or many of these points. Implementation /develop- ment/experimentation/simulation/testing/building the techniques/processes

**Collaborative/Sponsored Project**

Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for project work.

Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization at the start of semester VI.

Proposed Collaborative Project work need to be reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of 12 months.

Final assessment will be carried out in presence of faculty mentor, external mentor and examiner.

**TIMELINE**

1. Freezing of project groups and titles. Refinement of title and objectives from Sem V should freezed by the time of first review.
2. Final Synopsis of the project. (To be done at guide level)
3. Methodology / System Design / Block Diagram should be properly explained by the student
4. Project Review I Presentation.
5. Project Implementation: Students should take the work in one and/more of the points. Like Implementation/development/experimentation/simulation/testing/experimental yield/building the techniques/processes etc. . .
6. Based on the points discussed in 5, student would be able to get results and discuss them. Students should be able to draw inferences from results.
7. Project Review II Presentation.
8. Quality of Publication and Researchers: Students would be educated on different technical papers and their importance (article types, journal metrics etc) along with author/researcher credentials.
9. Project Documentation: Project Report Writing

**ASSESSMENT and EVALUATION**

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Project Review I: Problem Statement and objectives, Implementation plan & action (algo- rithms/techniques/models/mathematical understanding/implementation) (10 Marks)
2. An activity on illustrating methodology. This may inlcude paper reading activity: Read and Summarize a paper in 1 page (Individual to every student of the group). Any other activity can also be taken take would illustrate methodology (10 marks)
3. Project Review II: Results and Implementation, Observations, Inferences, Discussion on algo- rithms / techniques /models / testing) (10 Marks)
4. Article Quality and Author Credentials: Information about Research Article types, paper quality metrics (SCI/SCOPUS/WOS) and Author Credentials (Citation count, h-index, I10 index etc) (5 marks)
5. Project Report (10 Marks)
6. Project: Documentation Final Presentation and Demonstration (30 Marks)

~~(Parameters of evaluation: Final implemented work, report, presentation and paper~~ drafted based on work)

MIT | Academy of Engineering

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# MIT ACADEMY OF ENGINEERING, ALANDI

## Curriculum for Final Year Bachelor of Technology DEPARTMENT OF ARTIFICIAL INTELLIGENCE

## NEP REVISION 2023 ( (NEP))

(With Effect from Academic Year: 2027-2028)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W. E. F | : | 2027-2028 |
| FINAL YEAR BACHELOR OF TECHNOLOGY | RELEASE DATE | : | 01/07/2026 |
| | REVISION NO. | : | (NEP) |

| SEMESTER: VII (PART A) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2304411T | System Design | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 | |
| PEC | 2304421T | Big Data Analytics | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 | |
| | 2304422T | Generative AI Applications | | | | | | | | | | | |
| | 2304423T | Cloud Native DevOps | | | | | | | | | | | |
| | 2304424T | Ethical Hacking & Cyber Laws | | | | | | | | | | | |
| | 2304421L | Big Data Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| | 2304422L | Generative AI Applications Lab | | | | | | | | | | | |
| | 2304423L | Cloud Native DevOps Lab | | | | | | | | | | | |
| | 2304424L | Ethical Hacking & Cyber Laws Lab | | | | | | | | | | | |
| MDM | *MDM List | Multidisciplinary Minor Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HSSM MEC | 2304476 T | Project Management | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2304491L | Major Project - III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC PRJ | 2304492T | Research Methodology | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC SI | 2304496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| **TOTAL** | | | **13** | **6** | **-** | | | | | | **750** | **20** |

| | | | |
|---|---|---|---|
| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | **COURSE STRUCTURE (NEP** | | |
| **DEPARTMENT OF ARTIFICIAL INTELLIGENCE** | **W. E. F** | **:** | |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **RELEASE DATE** | **:** | |
| | **REVISION NO.** | **:** | |

**SEMESTER: VIII (PART A)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304412T | Cyber Security | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 230442XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2304SWXX | SWAYAM Course* | - | - | - | 25 | - | 75 | - | - | | |
| MDM | *MDM List | MDM Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 23XXSWXX | SWAYAM Course (MDM)* | - | - | - | 25 | | 75 | - | - | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OE | 2301451L | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2304497L | Semester-Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 2304498L | Semester Exchange | - | - | - | - | - | - | | | | |
| | 2304493L | Capstone Portfolio | - | - | - | - | - | - | | | | |
| **TOTAL** | | | **10** | **4** | | | | | | | **725** | **20** |

*Credits earned in advance through a credit transfer scheme

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W. E. F | : | 2027-2028 |
| FINAL YEAR BACHELOR OF TECHNOLOGY (DEPARTMENT OF ARTIFICIAL INTELLIGENCE ) | RELEASE DATE | : | 01/07/2026 |
| | REVISION NO. | : | (NEP) |

| SEMESTER: VII (PART B) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304411T | System Design | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| MDM | *MDM List | Multidisciplinary Minor Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 |
| ELC PRJ | 2304491L | Major Project - III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 2304499L | Industry Practicum | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| ELC SI | 2304496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 |
| TOTAL | | | 6 | 4 | - | | | | | | 750 | 20 |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP REVISION 2023) | | |
|---|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W. E. F | : | 2027-2028 |
| FINAL YEAR BACHELOR OF TECHNOLOGY (DEPARTMENT OF ARTIFICIAL INTELLIGENCE ) | RELEASE DATE | : | 01/07/2026 |
| | REVISION NO. | : | (NEP) |

**SEMESTER: VIII (PART B)**

| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CODE | NAME | HOUR/WEEK | | | THEORY | | | PRACT | | TOTAL | |
| | | | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2304412T | Cyber Security | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 230442XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2304SWXX | SWAYAM Course* (PEC) | - | - | - | 25 | - | 75 | - | - | | |
| MDM | *MDM List | MDM Course-V | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 23XXSWXX | SWAYAM Course* (MDM) | - | - | - | 25 | | 75 | - | - | | |
| OE | 2301451L | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELCSI | 2304497L | Semester-Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 2304498L | Semester Exchange | - | - | - | - | - | - | | | | |
| | 2304493L | Capstone Portfolio | - | - | - | - | - | - | | | | |
| TOTAL | | | 10 | 4 | | | | | | | 725 | 20 |

*Credits earned in advance through a credit transfer scheme

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | SYSTEM DESIGN |
| | COURSE CODE | |
| | COURSE CREDITS | |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 4 | NIL | 60 | NIL | 90 | NIL | NIL | 150 |

**PREREQUISITE : Software Engineering**

**COURSE OBJECTIVES :**

2304411T.CEO.1: 1.To Introduce the fundamental principles of system design, architectural styles, and system types used in modeling real-world applications. .

2304411T.CEO.2: To impart an understanding of human-computer interaction and usability principles to ensure system designs meet user needs effectively.

2304411T.CEO.3: To familiarize with the design process and

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304411T.CO.1: Analyze system design principles to model real-world applications using appropriate architectural styles, system types, and modeling tools.[L4]

2304411T.CO.2: Apply human-computer interaction principles and usability heuristics for effective and user-friendly interfaces for responsive systems.[L3]

2304411T.CO.3: Identify interactive system components using contextual inquiry, iterative design, and interaction styles .[L3]

2304411T.CO.4: Evaluate system designs for security, accessibility, and ethical compliance.[L5]

**COURSE ABSTRACT:**

System Design introduces students to the principles and practices involved in designing scalable, reliable, and user-centered software systems. It covers the end-to-end design process from high-level architecture to low-level component design while integrating essential concepts from Human-Computer Interaction and UI/UX design.The course prepares students to design modern software systems that are not only efficient and robust, but also accessible and user-friendly.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION TO SYSTEM DESIGN & MODELING CENTERED NEEDS** | **10 HOURS** |

**Applications/Case Study:** Online Course Management System,Ride-Sharing App (like Uber),Smart Home Automation System.

**Contents:** Definition and characteristics of system design, Types of systems: Monolithic, Dis- tributed, Microservices, Design considerations: Scalability, reliability, availability, fault tolerance, maintainability, Architectural styles: Layered, Client-server, Microservices, Event-driven, Communi- cation protocols: REST vs WebSockets ,Requirement gathering and UML Modeling.

**Self Study:** Event-Driven Architecture-Role of asynchronous communication,Event sourcing vs. traditional CRUD models.
**Further readings:** Domain-Driven Design (DDD) – Strategic Concepts, Ubiquitous language,
Bounded contexts.

| | | |
|---|---|---|
| **UNIT 2** | **USABILITY DESIGN** | **10 HOURS** |

**Applications/Case Study:** Online Food Delivery Platform, E-commerce Website,Messaging App(WhatsApp).

**Contents:**Human-Computer Interaction:Importance,Role, Human Factors in system design :Cognitive and Physical, Ergonomics, Usability, User Interface (UI) principles , Bridging Requirements with UX design:User-centered insights, High Level Design: Performance and Maintainability, Interaction Models in Architecture: Norman's Action Cycle & Gulf of Execution/Evaluation, Aligning system flow with user tasks and feedback loops,Shneiderman's Eight Golden Rules for Interface Design,UI behavior under different architectural choices (real-time vs batch).

**Self Study:** Psychology and the design of Interactive Systems.
**Further Readings:**Agent based Interfaces.

| UNIT 3 | DESIGN PROCESS AND INTERACTION STYLES | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Travel Booking System(MakeMyTrip),Inventory Management UI, Dash- board for IoT Data.

**Contents:** Four Pillars of Design, Process of Design, Ethnographic Observations, ContextualInquiry, Iterative Design, Participatory Design, Navigation Design, Visual Design: Layout, Color,Fonts, Label- ing,Scenarios,Interaction Styles:Direct Manipulation, Menu Selection, Form-Filling, Commands, Nat- ural Language, Internationalization, Interaction Design Patterns,HCI in software process: interactive systems and SDLC.

**Self Study:** GOMS(Goals, Operators, Methods, and Selection rules) Keystroke-Level Model:Efficiency in interface actions.

**Further Readings:** Responsive and Adaptive UI Design, UI structure adaptation across de- vices(desktop, mobile, kiosk).

| UNIT 4 | PERFORMANCE, SCALABILITY AND USABILITY EVALU- ATION | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Case Study on Live Quiz App,Election Result Dashboard.

**Contents:** System Performance, Scalability-Horizontal vs vertical scaling,load balancing, Content Delivery Network and edge computing for faster content delivery, Caching strategies for UI respon- siveness (front-end and back-end), Performance bottlenecks: detection and profiling, Evaluation: Heuristic Evaluation, Cognitive Walkthrough, Expert Reviews, User Surveys, Think Aloud, A/B testing, heatmaps, analytics.

**Self Study:** Case Studies of High-performance systems with good/bad UX.

**Further readings:** Information Architecture.

| UNIT 5 | Security, Accessibility, and Ethical Design in Systems | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Healthcare Portal (HIPAA-compliant system)-Secure UI and audit log- ging,Social Media Platform-Analysis of ethical concerns (privacy, addiction, content surfacing), Gov- ernment Service Portal- Accessibility audit and improvement plan

**Contents:** Authentication and Authorization (OAuth2, JWT), Secure UI design (password inputs, feedback handling), Data privacy principles (PII, GDPR, HIPAA), Accessibility in System Design: Importance of inclusive design, WCAG principles (Perceivable, Operable, Understandable, Robust), Designing for diverse user needs (visual, motor, cognitive impairments), Ethics and Responsible De- sign: Dark patterns vs user-centered design, Designing for transparency and informed consent, Data ethics: What not to collect, when not to personalize etc.

**Self Study:** Common Web Security Vulnerabilities.

**Further Readings:** AI and Ethics in Personalization.

| UNIT 6 | PROTOTYPE DESIGN | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Low Level Design for a Ride-Sharing App Uber/Ola, Chat Application.

**Contents:** Common design patterns (Factory, Singleton, Observer), Connecting UI flows to system functions (LLD-to-UI mapping) , frontend–backend integration principles, state management in UI applications including Redux and Context API, SOLID principles in UI and backend service design.

**Self Study:** Job Scheduling System (e.g., Cron, Airflow): Design classes and interactions.
**Further Readings:** Patterns for Effective Interaction Design.

**TEXT BOOKS**


Alen Dix,Janet Finlay,Human Computer Interaction,4th Edition,Pearson Publication,ISBN 0130461091

Grady Booch, James Rumbaugh, and Ivar Jacobson,The Unified Modeling Language User Guide,Addison Wesley,ISBN 978-0134852157

Martin Kleppmann, Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems,O'Reilly

Richard N. Taylor, Nenad Medvidovic, Eric Dashofy Software Architecture: Foundations, Theory, and Practice,Wiley,978-0470167748

Alex Xu,System Design Interview:An Insider's Guide (Vol 1&2),Publisher:Shroff/bytebytego,979- 8664653403


**REFERENCE BOOKS**


Kent Norman, JurekKirakowski, Handbook of Human Computer Interaction" Wiley Publication,ISBN 9781118976135

Martin L. Abbott ,Michael T. Fisher, The Art of Scalability-Scalable Web Architecture, Processes,and Organizations for the Modern Enterprise,Addison Wesely 978-0-13-403280-1.

Sam Newman, Building microservices.O'Reilly, ISBN 9789391043384

Nick Rozanski E´oin Woods,Software Systems Architecture,ISBN - 978-8131726136

Allen I. Hollub, Compiler Design in C, PHI, 2015. ISBN: 978-93-325-4950-0

Helen Sharp, Jenifer Preece Interaction Design beyond Human Computer Interaction" 5th Edition, ISBN 978-1119547259

Donald Norman, The Design of Everyday Things", 2002 Edition, Basic Books, ISBN 100-465067107

Wilbert O. Galitz,The Essential Guide to User Interface Design, 2nd Edition, Wiley-dreamtech India (P) Ltd., ISBN 81-265-0280-0.


**E-RESOURCES**

Microservices *blog.dreamfactory.com/microservices-examples*

*https://arxiv.org/abs/2006.04975*

3. Models and Techniques for Ensuring Safetv. Availabilitv. and Reliabilitv.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Big Data Analytics |
| | COURSE CODE | 2304421T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**COURSE OBJECTIVES :**

2304421T.CEO.1: To discuss the significance of big data technologies in data-driven world. 2304421T.CEO.2: To demonstrate usage of big data analytical tools and Map reduce, Apache Spark frameworks.

2304421T.CEO.3: To examine case studies that illustrate big data analytics applications in the health- care, finance, retail domain

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304421T.CO.1: Demonstrate Big Data technologies and Hadoop ecosystem components [L3].

2304421T.CO.2: Apply big data concepts, architectures, and frameworks to solve large-scale data problems. [L3].

2304421T.CO.3: Apply big data technologies, including Pig, Hive, and Apache Spark, to analyze large- scale datasets.[L3].

2304421T.CO.4: Analyze real-world case studies and select appropriate big data tools and frameworks for their resolution.[L4].

**COURSE ABSTRACT:**

This course on Big Data Analytics provides a comprehensive overview of the principles, technologies, and tools used to manage, analyze, and visualize large datasets. Students will explore the characteristics of big data, including its volume, velocity, variety, veracity, and value. Through hands-on projects and real-world case studies, participants will gain experience using popular big data technologies such as Hadoop, Hive, Apache Spark, and NoSQL databases like Habse. By the end of the course, students will be equipped with the skills and knowledge necessary to apply big data analytics in various industries, enabling them to make data-driven decisions

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction To Big Data And Hadoop** | **08 HOURS** |

**Applications/Case Study:** Healthcare Monitoring and cause Detection
**Contents:** Introduction to Big Data, Sources of Big Data, 5 V's of Big Data, Big Data Analytics, Challenges of Traditional System, Challenges of Big data, Distributed Systems, Introduction to Apache Hadoop, Hadoop Features, Components of Hadoop Ecosystem, Hadoop Architecture, Com- mercial Hadoop Distributions.
**Self Study:** Environmental Setup and Custer management of Hadoop
**Further Readings:** Hadoop Security Architecture .

| | | |
|---|---|---|
| **UNIT 2** | **HDFS (Hadoop Distributed File System)** | **06 HOURS** |

**Applications/Case Study:** Retail Analytics with HDFS.
**Contents:** Introduction to HDFS, Features and Goals, Internal Architecture and HDFS Workflow, HDFS Concepts, Command Line Interface (CLI), Hadoop file system interfaces, HDFS File Operations, YARN Components, Benefits of YARN,Data flow, Data Ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: Compression, Serialization - Avro, parquet, File-Based Data structures.
**Self Study:** Performance Evaluation in HDFS.
**Further Readings:** HDFS architecture in cloud computing.

| | | |
|---|---|---|
| **UNIT 3** | **Map Reduce Framework** | **06 HOURS** |

**Applications/Case Study:** Search: Web Indexing.
**Contents:** Introduction to MapReduce, Framework, Compilation and Execution Process Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map-Reduce Types and Formats, Map Reduce Features. MapReduce Use Cases. Input Splits, Relation between Input Splits and HDFS Blocks Combiner Practitioner.
**Self Study:** Map Reduce versus Spark.
**Further Readings:** Map reduce in Cloud Computing.

| UNIT 4 | Apache Pig and Hive | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Sentiment Analysis on social media.

**Contents: Apache Pig -** Introduction to PIG, Execution Modes of Pig, Pig-Latin Grunt, Pig data types, Load and Store operations. The Pig operators- Diagnostics Operators, Data Processing oper- ators, Relational Operators, Group Operator, Joins, Union in Pig, Built In Functions (Eval, Math, String, Date).

**Apache Hive -** Introduction to Hive, Hive Shell, Hive Services, Hive Metastore, Hive DDL and DML, Hive Databases, creating new table, Basics and Internal Table, external table, Loading Different File Formats, Load Data Into Hive Table, Hive Indexes and View, Hive Partitions Buckets, Hive Function Built-in User Defined Functions.

HiveQL: Simple Operations On Hive Table, query operations on hive table, Querying Complex Struc- tures From A Table, Join Sub-Query.

**Self Study:** Difference between Pig and Hive. Technology Comparison with Traditional Databases.

**Further Readings:** Hive ETL

| UNIT 5 | Hadoop Databses - Apache HBase, Cassandra, CouchDB | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Financial Services Analytics with HBase.

**Contents:** Apache HBase: Introduction, Concepts, HBase Vs RDBMS, HBase prerequisites, Base Architecture, Components, and Data Model, HBase Shell Commands, HBase Table operations, Create, Insert Retrieve Data in HBase, Using Apache HBase Shell, Conceptual Physical View, Name-space, Tables, Rows, Cells Column Family, Sort Order, Column Metadata, joins, ACID, Schema Design,Row Key design,Constraints,Catalog Tables, Storing Medium-sized Objects, Backup and Restore commands. Introduction to Cassandra, CouchDB.

**Self Study:** NoSQL Databases

**Further Readings:** NoSQL Databases integration in cloud technology.

| UNIT 6 | Apache Spark | 09 HOURS |
|---|---|---|

**Applications/Case Study:** Recommender systems.

**Contents:** Introduction, Spark Architecture, Spark Cluster Architecture, Spark Master and Worker node Service, Spark DAG, Spark Executor Spark core programming concepts, compilation and execu- tion of spark program. Resilient distributed databases (RDD),

Introduction to Spark Data Frames, Data Frames Overview, Spark Data Frame Operations, Group By and Aggregate Functions, Missing data, Date and Timestamps.

**Self Study:** Hadoop MapReduce Vs Apache Spark.

**Further Readings:** Mobile big data analysis using Apache Spark.

**TEXT BOOKS**


DT Editorial Services. (2016). *Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization*. 1st Edition, Dreamtech Press. ISBN: 978-8184891430.

Tom White.(2016). *Hadoop: The Definitive Guide*. 4th Edition, O'Reilly. ISBN: 978-9352130672.

Lars George. (2011). *HBase: The Definitive Guide - Random Access to Your Planet-Size Data*. 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9350235034.

4. Bill Chambers.(2018). *Spark: The Definitive Guide - Big Data Processing Made Simple* . 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9352137060.


**REFERENCE BOOKS**


Dipak Vohra (2016). *Practical Hadoop Ecosystem:A Definitive Guide to Hadoop Frameworks and Tool*. 1st Edition, A-Press, ISBN: 978-1484221983.

Arshdeep Bahga, Vijay Madisetti. (2016). *Big Data Science Analytics: A Hands-On Approach*. 1st Edition, VPT, ISBN: 978-0996025546.

Vaddeman, Balaswamy. (2018). *Beginning Apache Pig*. 1st Berkeley, CA: Apress. ISBN: 978-1484223369.

Holden Karau, Rachel Warren. (2017). *Beginning Apache Pig*. 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9352135615.

Mamta Mittal , Valentina E. Balas , Lalit Mohan Goyal, Raghvendra Kumar. (2018). *Big data*


**E-RESOURCES**

https://hadoop.apache.org/docs/stable/

https://nptel.ac.in/courses/106104189

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Big Data Analytics Lab |
| | COURSE CODE | 2304421L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Requires knowledge of Descriptive Analytics, Predictive Analytics

**COURSE OBJECTIVES :**

2304421L.CEO.1: To explore the significance of big data technologies in data-driven world. 2304421L.CEO.2: To demonstrate usage of Bigdata frameworks Map reduce, Apache Spark to perform analytics over large datasets.

2304421L.CEO.3: To illustrate usage of analytical tools and ecosystem componemts like Pig, Hive, Hbase etc.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304421L.CO.1: Apply big data tools and frameworks (e.g., Hadoop, Map Reduce, Spark) to process large datasets. [L3].

2304421L.CO.2: Analyze large datasets using technologies pig, hive, Apache spark, etc.[L4]. 2304421L.CO.3: Evaluate real-world case studies using big data implementations. [L5].

2304421L.CO.4: Develop visualization and dashboards to interpret and communicate analytical results effectively [L3].

**COURSE ABSTRACT:**

This course on Big Data Analytics provides a comprehensive overview of the principles, technologies, and tools used to manage, analyze, and visualize large datasets. Students will explore the characteristics of big data, including its volume, velocity, variety, veracity, and value. Through hands-on projects and real-world case studies, participants will gain experience using popular big data technologies such as Hadoop, Hive, Apache Spark, and NoSQL databases like Habse. By the end of the course, students will be equipped with the skills and knowledge necessary to apply big data analytics in various industries, enabling them to make data-driven decisions.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Hadoop Installation and Commands** | **4 HOURS** |
| A. Installation of the Hadoop under windows 10/ Linux (Min. 2 GBRAM)/ Virtual Machines or Hadoop Distribution of Cloudera (Min Requirement 8 GB RAM)<br>B. Execution of basic Hadoop Commands | | |
| **PRACTICAL NO.02** | **Map Reduce Framework** | **4 HOURS** |
| Implementation of Word Count program using Map Reduce Framework. | | |
| **PRACTICAL NO.03** | **Apache Pig** | **4 HOURS** |
| Apache PIG exercises using Given dataset Create two file as fil11.txt and file2.txt, Insert students details (least 10 records) like (rollno, name, age, city, etc) but not limited to, and perform following operations 1. Load the files using PigStorage<br>4. Perform task using Diagnostic Operator - Dump operator,Describe operator,Explain operator, Il- lustration operator<br>5. Grouping and Joining - Group Operator, Cogroup Operator, Join Operator,Cross Operator<br>6. Combining Splitting - Union Operator, Split Operator<br>7. Filtering - Filter Operator, Distinct Operator, Foreach Operator<br>8. Sorting - Order By, Limit Operator<br>9. Built-in Functions | | |
| **PRACTICAL NO.04** | **Apache Hive** | **4 HOURS** |
| Apache Hive: DDL, DML Statement using Apache Hive Execution of Given Queries on various dataset. | | |
| **PRACTICAL NO.05** | **Apache HBase** | **4 HOURS** |
| Apache HBase: DDL, DML Operations, HBase Operations- read and Write using Metatable. | | |
| **PRACTICAL NO.06** | **Apache Spark** | **4 HOURS** |
| Social Media (Facebook/witter) Analysis using Spark. | | |
| **MINI PROJECTS** | **For Practical Exam** | **6 HOURS** |
| Students need to complete mini project which will be evaluated under Practical Exam. | | |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Generative Artificial Intelligence |
| | COURSE CODE | 2304422T |
| | COURSE CREDITS | 3 |
| RELEASE DATE: | REVISION NO. | 0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Machine Learning, Deep Learning.

**COURSE OBJECTIVES :**

2304422T.CEO.1: Understand principles of generative models.

2304422T.CEO.2: Develop practical skills in building and deploying generative AI models. 2304422T.CEO.3: Analyze ethical considerations and impacts of generative AI in different fields. 2304422T.CEO.4: Explore advanced models such as GANs, VAEs, Diffusion Models, and Transformer-based architectures.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304422T.CO.1: Develop Generative AI models and diffusion models to generate data across various domains like images, text, and music [L3].

2304422T.CO.2: Use industry-standard tools and platforms for building, deploying, and scaling generative AI models [L3].

2304422T.CO.3: Analyze the performance of Generative AI models for real world applications [L4].

2304422T.CO.4: Determine the ethical challenges posed by generative AI technologies, including bias, misinformation, and intellectual property concerns [L5].

**COURSE ABSTRACT:**

This advanced course in Generative AI explores the theoretical underpinnings and practical implemen- tations of AI models capable of generating original content. Leveraging foundational knowledge from Artificial Intelligence and Machine Learning and Deep Learning, students will delve into the architec- ture, training, and application of generative models, including Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Transformer-based models such as GPT.

Through hands-on projects and case studies, students will learn to design, implement, and evaluate generative models for tasks such as image synthesis, text generation, and style transfer. Emphasis is placed on understanding the ethical implications and potential biases of generative AI, as well as methods to mitigate risks in applications. By the end of the course, students will have practical expertise in deploying generative models and insights into emerging applications across industries.

**THEORY COURSE CONTENTS**

| UNIT 1 | Introduction to Generative AI | 08 HOURS |
|---|---|---|

**Applications/Case Study:** AI-Generated Music:Open AI's Jukebox, Text Generation:AI Dungeon **Contents:** Overview of AI and generative models. Difference between discriminative and generative models. Applications of generative models (art, music, image generation, etc.). Historical context of generative models. Large Language Models.

**Further Readings:** Interactive Generative Systems

| UNIT 2 | Autoencoders and Variational Autoencoders (VAE) | 09 HOURS |
|---|---|---|

**Applications/Case Study:** Medical Imaging, Anomaly Detection, Customer Segmentation and Recommendations

**Contents:** Introduction to Autoencoders (AE): Encoder, Decoder, Applications (Data Compression, Denoising). Variational Autoencoders (VAE): KL divergence, reparameterization trick, latent space exploration.

**Self Study:** Limitations of AEs and VAEs (overfitting, interpretability)

| UNIT 3 | Generative Adversarial Networks (GANs) | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Synthetic Medical Imaging Data, Deepfake Creation and Detection. **Contents:** Introduction to GANs: Generator and Discriminator structure, Adversarial loss, Minimax optimization. Types of GANs: Vanilla GAN, Deep Convolutional GANs (DCGAN), Conditional GANs, Progressive Growing GAN. Challenges in GAN Training: Mode collapse, vanishing gradients.

**Further Readings:** Style Transfer and Creativity in Design: StyleGAN, CycleGAN

| UNIT 4 | Transformer-based Generative Models | 08 HOURS |
|---|---|---|

**Applications/Case Study:** OpenAI GPT-3, DALL-E and DALL-E 2, BERT.
**Contents:** Introduction to Transformers: Self-attention mechanism, Positional encoding. Transformer-based Generative Models: GPT (GPT-2, GPT-3), BERT for generative tasks. Text-to- Image Synthesis, Vision Transformers (ViT) and generative applications in image generation.

**Further Readings:** Creative Industries: Content Creation in Art, Music, and Design.

| UNIT 5 | Diffusion Models | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Medical Imaging Enhancement, Automotive Design and Simulation **Contents:** Introduction to Denoising Diffusion Probabilistic Models (DDPM). Producing high-quality, diverse outputs in image, video, and text generation
Iterative and probabilistic approach: Forward diffusion (adding noise) and reverse process (denoising)

**Self Study:** Multimodal Models

| UNIT 6 | Ethical, Societal, and Legal Dimensions of Generative AI | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Medical Imaging Enhancement, Automotive Design and Simulation **Contents: Ethics:** Fairness, transparency, accountability, bias mitigation, privacy, and human-AI collaboration in global and Indian contexts.
**Society:** Misinformation, job displacement, cultural diversity, trust restoration, and applications in education and healthcare worldwide and in India.
**Policy Law:** EU AI Act, General Data Protection Regulation, India's IT Act, Data Protection Bill, copyright, intellectual property, liability, and AI governance frameworks.
**Security Sustainability:** Deepfakes, misuse prevention, energy efficiency, carbon footprint, Paris Agreement, and National AI Strategy (NITI Aayog).

**TEXT BOOKS**


Jozefowicz, R., Zaremba, W., Sutskever, I. (2023). An Introduction to Generative Models with Applications. Cambridge University Press.

Choi, H., Kim, J. (2023). Generative AI: A Practical Guide to Applications and Ethics. Springer.

Liu, L., Xu, H. (2020). Generative deep learning: Teaching machines to paint, write, compose, and play. O'Reilly Media.

Goodfellow, I., Bengio, Y., Courville, A. (2016). Deep learning. MIT Press. https://www.deeplearningbook.org/

**REFERENCE BOOKS**

Ramesh, A., Pavlov, M., Goh, G., et al. (2022). DALL·E: Creating images from text. OpenAI. Retrieved from https://openai.com/research/dall-e

Lee, J., Kim, J. (2023). Generative AI for Software Engineering: Techniques and Tools. CRC Press.

**E-LEARNING RESOURCES**

Swayam Course on Generative AI and Large Language Models, By Naveen Kumar Bhansali, Indian Institute of Management Bangalore (IIMB).

OpenAI. (n.d.). Research and blog on AI advancements. Retrieved from https://www.openai.com/blog.

Coursera. (n.d.). Generative adversarial networks (GANs) specialization by DeepLearning.AI. Coursera. Retrieved from https://www.coursera.org

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Generative Artificial Intelligence LAB |
| | COURSE CODE | 2304422L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Machine Learning, Deep Learning.

**COURSE OBJECTIVES :**

2304422L.CEO.1: Develop practical skills in building and deploying generative AI models. 2304422L.CEO.2: Analyze ethical considerations and impacts of generative AI in different fields. 2304422L.CEO.3: Explore advanced models such as Generative Adversarial Networks , Variational Autoencoders, Diffusion Models, and

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304422L.CO.1: Analyze Generative AI models and diffusion models to generate data across various domains like images, text, and music [L4].

2304422L.CO.2: Evaluate the performance of Generative AI models for real world applications [L5].

2304422L.CO.3: Deploy generative AI for practical applications such as image synthesis, data augmentation, and creative content generation [L6].

**COURSE ABSTRACT:**

This advanced course in Generative AI explores the theoretical underpinnings and practical implemen- tations of AI models capable of generating original content. Leveraging foundational knowledge from Artificial Intelligence and Machine Learning and Deep Learning, students will delve into the architec- ture, training, and application of generative models, including Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Transformer-based models such as GPT.

Through hands-on projects and case studies, students will learn to design, implement, and evaluate generative models for tasks such as image synthesis, text generation, and style transfer. Emphasis is placed on understanding the ethical implications and potential biases of generative AI, as well as methods to mitigate risks in applications. By the end of the course, students will have practical expertise in deploying generative models and insights into emerging applications across industries.

| **PRACTICAL EXPERIMENTS** | | |
|---|---|---|
| **PRACT 1** | **Introduction to Generative AI** | **04 HOURS** |
| **Practical Experiment:**<br>4. Setting Up the Environment for Generative AI and Make use of generative models for creative content generation.<br>5. Implement simple probabilistic models like Gaussian Mixture Models. | | |
| **PRACT 2** | **Autoencoders and Variational Autoencoders (VAE)** | **04 HOURS** |
| **Practical Experiment**<br>4. Build a simple AE model for Dimensionality Reduction and Denoising.<br>5. Generate realistic faces or interpolate between facial features for creative applications in enter- tainment and design using VAE. | | |
| **PRACT 3** | **Generative Adversarial Networks (GANs)** | **04 HOURS** |
| **Practical Experiment:** Implement a DCGAN and/or cGAN on a chosen dataset to generate original image data, providing a comprehensive summary of the GAN architectures, training processes, and generated results. Conduct a comparative analysis of the models, evaluating their effectiveness in image quality and consistency. Conclude with a presentation that includes a case study analysis, discussing ethical considerations and challenges in real-world GAN applications. | | |
| **PRACT 4** | **Transformer-based Generative Models** | **04 HOURS** |

**Practical Experiment:**

4. Generate coherent and contextually relevant text using GPT models.
5. Create images based on text prompts using a text-to-image model to explore Transformer capa- bilities in multimodal tasks.

| PRACT 5 | Diffusion Models | 04 HOURS |
|---|---|---|

**Practical Experiment:** Implement a basic diffusion model for image generation by simulating the process of adding and removing noise. Use a pre-trained diffusion model to generate images from text prompts and compare results, highlighting model strengths, limitations, and ethical considerations.

| PRACT 6 | Generative AI in Action: The Capstone Experience | 10 HOURS |
|---|---|---|

This Lab Experiment serves as the culmination of the Generative AI course, where students apply their acquired knowledge and skills to develop a capstone project that demonstrates innovative use of generative models. Students will work in teams to ideate, design, and implement a project that addresses a real-world challenge or explores a creative application of generative AI. Learning Outcomes:

3. Formulate a project proposal based on identified needs or creative ideas in the field of Gen AI.
4. Collaborate effectively in teams to execute a Gen AI project.
5. Implement, Analyze and Evaluate a Gen AI model using appropriate methodologies and tools.
6. Communicate project outcomes through a detailed report/article and a professional presentation.

**TEXT BOOKS**

Jozefowicz, R., Zaremba, W., Sutskever, I. (2023). An Introduction to Generative Models with Applications. Cambridge University Press.

Choi, H., Kim, J. (2023). Generative AI: A Practical Guide to Applications and Ethics. Springer.

Liu, L., Xu, H. (2020). Generative deep learning: Teaching machines to paint, write, compose, and play. O'Reilly Media.

Goodfellow, I., Bengio, Y., Courville, A. (2016). Deep learning. MIT Press. https://www.deeplearningbook.org/

**REFERENCE BOOKS**

Ramesh, A., Pavlov, M., Goh, G., et al. (2022). DALL·E: Creating images from text. OpenAI. Retrieved from https://openai.com/research/dall-e

Lee, J., Kim, J. (2023). Generative AI for Software Engineering: Techniques and Tools. CRC Press.

**E-LEARNING RESOURCES**

Swayam Course on Generative AI and Large Language Models, By Naveen Kumar Bhansali, Indian Institute of Management Bangalore (IIMB).

OpenAI. (n.d.). Research and blog on AI advancements. Retrieved from https://www.openai.com/blog.

Coursera. (n.d.). Generative adversarial networks (GANs) specialization by DeepLearning.AI. Coursera. Retrieved from https://www.coursera.org

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **DEPARTMENT OF ARTIFICIAL INTELLIGENCE** | **W.E.F** | **AY:** |
| **FINAL YEAR BACHELOR OF TECHNOLOGY**<br>**DEPARTMENT OF ARTIFICIAL INTELLIGENCE** | **COURSE NAME** | CLOUD NATIVE DEVOPS |
| | **COURSE CODE** | 2304423T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : 01/07/2025** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE :** Requires knowledge of Cloud Computing Foundations Cloud Native Application Development

**COURSE OBJECTIVES :**

2304423T.CEO.1: To explain the historical development of DevOps, and focusing on its role in bridging the gap between development and operations teams.

2304423T.CEO.2: To guide students in understanding the architecture, fundamental concepts, and essential components of Ansible.

2304423T.CEO.3: To equip students with the skills to build, manage, and deploy Docker containers

2304423T.CEO.4: To prepare students to set up and configure a Kubernetes cluster on AWS 2304423T.CEO.5: To train students to monitor and troubleshoot CI/CD pipelines in Jenkins.

2304423T.CEO.6: To develop students' ability to write Terraform configuration files.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304423T.CO.1: Describe the benefits of adopting DevOps practices in development.[L2] 2304423T.CO.2: Apply Ansible's automation of system configuration and deployment.[L3] 2304423T.CO.3: Deploy scalable, available containerized applications on AWS.[L3]

2304423T.CO.4: Analyze the architecture and components of Kubernetes within an AWS environment.[L4]

2304423T.CO.5: Evaluate CI/CD pipelines in Jenkins for software workflows.[L5] 2304423T.CO.6: Analyze the Terraform configuration files within an AWS environment.[L4]

**COURSE ABSTRACT:**

The Cloud Native DevOps course provides an in-depth exploration of modern development and opera- tional practices designed for cloud-native environments. It covers key concepts, tools, and methodologies such as containerization, microservices, CI/CD pipelines, infrastructure as code, and observability. Par- ticipants will learn to build, deploy, and manage scalable, resilient, and automated applications using platforms like Kubernetes, Docker, and cloud services (e.g., AWS). Emphasizing hands-on learning, the course equips learners with skills to streamline workflows, optimize performance, and foster collaboration between development and operations teams, ensuring robust and agile cloud-native solutions.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction to Devops** | **07 HOURS** |

**Applications/Case Study:** Tech Solutions
**Contents:** DevOps: Introduction, Features, Architecture, Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI/CD.
**Self Study:** DevOps vs Traditional IT Practices
**Further Readings:** DevOps Case Studies.

| | | |
|---|---|---|
| **UNIT 2** | **Configuration Management: Ansible** | **08 HOURS** |

**Applications/Case Study:** FinTechCorp
**Contents:** Introduction to Ansible and Configuration Management, Ansible Inventory and Ad-Hoc Commands, Writing Ansible Playbooks, Advanced Playbook Features, Roles, and Best Practices
**Self Study:**Ansible Architecture.
**Further Readings:**Ansible in CI/CD Pipelines.

| | | |
|---|---|---|
| **UNIT 3** | **Containerization : Docker** | **08 HOURS** |

**Applications/Case Study:** CloudApps Inc.
**Contents:** Introduction to Docker and Containers, Working with Docker Images and Dockerfile, Docker Compose and Multi-Container Applications, Docker on AWS (ECS, ECR, and Fargate), Con- tainer Orchestration and Scaling with AWS ECS and Fargate, Docker Security and Best Practices in AWS.
**Self Study:** Docker Architecture.
**Further Readings:**Docker Monitoring and Logging.

| UNIT 4 | Kubernetes | 07 HOURS |
|---|---|---|
| **Applications/Case Study:** AppTech Solutions<br>**Contents:** Introduction to Kubernetes and AWS EKS, Kubernetes architecture, Core Kubernetes Concepts and Networking in AWS EKS, Storage, Monitoring, and Logging in Kubernetes on AWS, Security, Scaling, and Best Practices in AWS EKS.<br>**Self Study:** Kubernetes Configuration Management<br>**Further Readings:**Advanced Kubernetes Features | | |
| **UNIT 5** | **CI/CD using Jenkins** | **07 HOURS** |
| **Applications/Case Study:** RetailTech Solutions<br>**Contents:** Introduction to CI/CD and Jenkins Basics, Jenkins Job Configuration and Pipeline Cre- ation, Advanced Jenkins Pipelines and Integration with Tools, Continuous Deployment and Best Prac- tices.<br>**Self Study:** Building and Testing with Jenkins.<br>**Further Readings:** Security in Jenkins. | | |
| **UNIT 6** | **Resource provisioning using Terraform** | **08 HOURS** |
| **Applications/Case Study:** CloudServe Inc.<br>**Contents:** Introduction to Infrastructure as Code (IaC) and Terraform Basics, Building AWS Infras- tructure with Terraform, Advanced Terraform Features and AWS Resource Provisioning, Terraform Best Practices, Automation, and Security.<br>**Self Study:** State Management in Terraform.<br>**Further Readings:** Terraform Testing and Validation. | | |

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: (Rev. 2023(NEP)) |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | CLOUD NATIVE DEVOPS LAB |
| | COURSE CODE | 2304423L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : 01/07/2025 | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Requires knowledge of Cloud Computing Foundations, Cloud Native Application Development

**COURSE OBJECTIVES :**

2304423L.CEO.1: To explain the historical development of DevOps, and focusing on its role in bridging the gap between development and operations teams.

2304423L.CEO.2: To guide students in understanding the architecture, fundamental concepts, and essential components of Ansible.

2304423L.CEO.3: To equip students with the skills to build, manage, and deploy Docker containers

2304423L.CEO.4: To prepare students to set up and configure a Kubernetes cluster on AWS 2304423L.CEO.5: To train students to monitor and troubleshoot CI/CD pipelines in Jenkins.

2304423L.CEO.6: To develop students' ability to write Terraform configuration files.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304423L.CO.1: Deploy scalable, available containerized applications on AWS.[L3]

2304423L.CO.2: Analyze the architecture and components of Kubernetes within an AWS environ- ment.[L4]

2304423L.CO.3: Evaluate CI/CD pipelines in Jenkins for software workflows.[L5] 2304423L.CO.4: Analyze the Terraform configuration files within an AWS environment.[L4]

**COURSE ABSTRACT:**

The Cloud Native DevOps course provides an in-depth exploration of modern development and opera- tional practices designed for cloud-native environments. It covers key concepts, tools, and methodologies such as containerization, microservices, CI/CD pipelines, infrastructure as code, and observability. Par- ticipants will learn to build, deploy, and manage scalable, resilient, and automated applications using platforms like Kubernetes, Docker, and cloud services (e.g., AWS). Emphasizing hands-on learning, the course equips learners with skills to streamline workflows, optimize performance, and foster collaboration between development and operations teams, ensuring robust and agile cloud-native solutions.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Ansible Inventory and Ad-Hoc Commands.** | **4 HOURS** |
| 4. Install Ansible and verify the installation.<br>5. Setup SSH keys and run basic Ansible commands to test the connection.<br>6. Configure an inventory file and run Ad-Hoc commands.<br>7. Perform operations like starting/stopping services, installing packages on managed nodes. | | |
| **PRACTICAL NO.02** | **Ansible Playbooks.** | **2 HOURS** |
| 6. Write a basic playbook to automate the installation of Apache HTTP server and start the service.<br>7. Create tasks to manage configuration files.<br>8. Create roles to manage a multi-tier application.<br>9. Secure credentials with Ansible Vault. | | |
| **PRACTICAL NO.03** | **Docker Images and Dockerfile.** | **4 HOURS** |
| 5. Install Docker on your machine<br>6. Create a custom Dockerfile to build a basic Node.js or Python application.<br>7. Build and run the custom image.<br>8. Launch and manage the containers using Docker Compose commands. | | |
| **PRACTICAL NO.04** | **Docker on AWS.** | **4 HOURS** |
| 3. Push a custom Docker image to Amazon ECR.<br>4. Create an ECS cluster and define a task to run the container.<br>5. Deploy a containerized application using AWS Fargate.<br>6. Secure Docker containers by applying resource constraints. | | |
| **PRACTICAL NO.05** | **Core Kubernetes Concepts and Networking in AWS EKS.** | **2 HOURS** |

| |
|---|
| 4. Set up an AWS EKS cluster using eksctl.<br>5. Launch and configure worker nodes for the EKS cluster.<br>6. Deploy a sample application (e.g., Nginx or Node.js) on the EKS cluster.<br>7. Expose the application using a Kubernetes Service with an AWS ELB. |

| | | |
|---|---|---|
| **PRACTICAL NO.06** | **Storage, Monitoring, and Logging in Kubernetes on AWS.** | **4 HOURS** |
| 4. Deploy a stateful application (e.g., MySQL) with Persistent Volumes using AWS EBS.<br>5. Set up Cloud Watch monitoring and logs for an EKS cluster.<br>6. Use Prometheus and Grafana to monitor the Kubernetes cluster.<br>7. Configure Horizontal Pod Autoscaler (HPA) and Cluster Autoscaler for an application. | | |
| **PRACTICAL NO.07** | **Jenkins Job Configuration and Pipeline Creation.** | **4 HOURS** |
| 5. Install Jenkins on a local machine or cloud instance.<br>6. Explore Jenkins' user interface and configure basic settings.<br>7. Create and configure a Freestyle project to pull code from GitHub and run a build.<br>8. Write a simple Jenkins pipeline using the Pipeline Syntax. | | |
| **PRACTICAL NO.08** | **Advanced Jenkins Pipelines and Integration with Tools.** | **2 HOURS** |
| d) Create an advanced Jenkins pipeline with stages: Build, Test, Package, and Deploy.<br>e) Integrate Jenkins with Maven or npm to automate the build process.<br>f)Build a Docker image using a Jenkins pipeline and push it to Docker Hub.<br>g) Deploy the Dockerized application to a cloud provider (AWS EC2, Google Cloud, etc.). | | |
| **PRACTICAL NO.09** | **Building AWS Infrastructure with Terraform.** | **2 HOURS** |
| c) Install Terraform and configure it to interact with AWS.<br>d) Write a basic Terraform configuration file to launch an AWS EC2 instance.<br>e) Storing Terraform state locally vs. remotely (e.g., in S3).<br>f)State management commands: terraform show, terraform state list, terraform state rm. | | |
| **PRACTICAL NO.10** | **Advanced Terraform Features and AWS Resource Provisioning.** | **2 HOURS** |
| c) Use a Terraform module to provision a VPC with subnets, route tables, and an internet gateway.<br>d) Use data sources to find an AMI and launch an EC2 instance within the created VPC.<br>e) Automate the creation of an Auto Scaling Group with a Load Balancer and attach instances dynam- ically.<br>f)Set up a Terraform workspace for managing multiple environments (development, staging, produc- tion). | | |

g) Automate the provisioning of resources using a CI/CD pipeline (e.g., Jenkins with Terraform).

**TEXT BOOKS**


Wittig, Michael, Andreas Wittig, and Ben Whaley (2018). *Amazon web services in action*.

Raheja, Yogesh, Giuseppe Borgese, and Nathaniel Felsen. *Elective DevOps with AWS: Implement continuous delivery and integration in the AWS environment*. Packt Publishing Ltd, 2018.

Vehent, Julien. *Securing DevOps: security in the cloud*. Simon and Schuster, 2018.

Sarkar, Aurobindo, and Amit Shah. *Learning AWS: Design, build, and deploy responsive applications using AWS Cloud components*. Packt Publishing Ltd, 2018.


**REFERENCE BOOKS**


Kavis, Michael J. *Architecting the cloud: design decisions for cloud computing service models (SaaS, PaaS, and IaaS)*. John Wiley Sons, 2014.

Vacca, John R., ed.*Cloud computing security: foundations and challenges*. CRC Press, 2016.

Furht, Borivoje, and Armando Escalante. *Handbook of cloud computing*. Vol. 3. New York: springer, 2010.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **DEPARTMENT OF ARTIFICIAL INTELLIGENCE** | **W.E.F** | **AY:** |
| **FINAL YEAR BACHELOR OF TECHNOLOGY**<br>**DEPARTMENT OF ARTIFICIAL INTELLIGENCE** | **COURSE NAME** | Ethical Hacking and Cyber Laws |
| | **COURSE CODE** | 2304424T |
| | **COURSE CREDITS** | 3 |
| **RELEASE DATE : 01/07/2025** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**COURSE OBJECTIVES :**

2304424T.CEO.1: Equip learners with the knowledge of common hacking techniques, including pene- tration testing, vulnerability analysis, and exploit discovery.

2304424T.CEO.2: To gather detailed information about a target system or network, including IP ad- dresses, domain names, and network infrastructure.

2304424T.CEO.3: Identify the weaknesses in systems and networks before malicious actors exploit them with the help of vulnerability assessment methods.

2304424T.CEO.4: Explain the privilege escalation technique and gain access to a targeted system.

2304424T.CEO.5: Identify different web server attacks and countermeasures.

2304424T.CEO.6: To understand the step-by-step methodology used in web application hacking

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304424T.CO.1: Identify the hacking concepts, techniques, and scopes [L3].

2304424T.CO.2: Experiment with the digital footprint technique to better understand the system's structure, and detect vulnerabilities. [L3].

2304424T.CO.3: Identify, quantify, and prioritize vulnerabilities in a system, network, or application in order to analyze its security weaknesses and potential risks [L4].

2304424T.CO.4: Apply different techniques to privilege escalation and gain access to a system [L3].

2304424T.CO.5: Analyze various web server attacks and their countermeasures[L4].

2304424T.CO.6: Classify different techniques to perform various web application and mobile application attacks [L4].

**COURSE ABSTRACT:**

The Ethical Hacking Course provides hands-on experience in identifying, exploiting, and mitigating cybersecurity vulnerabilities. Participants use real-world tools and techniques to conduct penetration testing, vulnerability assessments, and simulated attacks on networks, systems, and web applications. The course emphasizes ethical hacking principles, legal considerations, and developing skills to safeguard organizational assets from malicious threats. Through practical exercises, learners gain proficiency in offensive and defensive cybersecurity strategies, preparing them for roles in ethical hacking, network security, and incident response.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **Security Foundations** | **06 HOURS** |
| **Applications/Case Study:** Case study on Ethical Hacking Methodology<br>**Contents:** Overview of Ethics and hacking, Attack Modeling, Methodology of Ethical hacking, In- formation Assurance and Risk, Policies, Standards, and Procedures, organizing your protections, and security technology.<br>**Self Study:** Ethical hacking phases<br>**Further Readings:** Risk assessment and management. | | |
| **UNIT 2** | **Footprinting and Reconnaissance** | **06 HOURS** |

**Applications/Case Study:** Demonstration to gather the information of targeted system
**Contents:** Footprinting: Concept, Footprinting through search engines, Web services, Social Network- ing Sites, Websites, email, Social engineering, Whois, DNS. Footprinting Countermeasures Scanning Networks: Network Scanning Concepts, Scanning Tools, Port and Service Discovery, OS Discovery, Vulnerability Scanning, packet crafting and manipulation.
**Self Study:**Nmap Scanning techniques.
**Further Readings:**Banner grabbing using scanning tools.

| UNIT 3 | Vulnerability Analysis | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Demonstration NESSUS tool for Vulnerability Assessment
**Contents:** Vulnerability Assessment Concepts, Classification and Assessment Types, Assessment So- lutions and Tools, Assessment Reports
**Self Study:** Explore the different methods in NESSUS/Acunetix, Burp Suite.
**Further Readings:** Generate the Vulnerability Assessment Report on the web application.

| UNIT 4 | System Hacking | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Demonstration on Social Engineering technique using Kali Linux
**System Hacking Concepts:** Searching for Exploits, Gathering passwords, password cracking, client- side vulnerabilities, Sniffing, Social Engineering, and Denial of Services.
**Self Study:** DDoS Attack and preventation methods.
**Further Readings:** Methods of authentication bypass

| UNIT 5 | Hacking Web Servers | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Case study on web server attack
**Contents:** Web server Concepts, Web Server attacks, webserver attack methodology, web server attack tools, Countermeasures, patch management, web server security tools.
**Self Study:** Explore web security tools in Kali Linux.
**Further Readings:** Web server password hacking , Session hijacking.

| UNIT 6 | Hacking Web Application and Wireless Network | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Demonstrate on SQL inject on web application
**Contents:** Web application concepts, threats, hacking methodology, Web Application Security, SQL Injection tools and techniques Wireless Networks: Concept, Encryption, Threats, Methodology and Tools, Wireless security: Wifi, bluetooth etc. Hacking Mobile Platforms: Mobile platform attack vectors, Hacking Android OS, Mobile device management, Mobile Security and Guidelines and tools **Self Study:** Identify different mobile application attacks and tools.
**Further Readings:** Packing sniffing methodology.

**REFERENCE BOOKS**

The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, 2nd Edition by Dafydd Stuttard and Marcus Pinto.

Gray Hat Hacking The Ethical Hackers Handbook, 3rd Edition" by Allen Harper and Shon Harris

**E-RESOURCES**

1. https://onlinecourses.nptel.ac.in/noc22_cs13/*course*

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | ETHICAL HACKING AND CYBER LAWS LAB |
| | COURSE CODE | 2304424L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Cryptography and System Security, Cyber Security Forensic

**COURSE OBJECTIVES :**

2304424L.CEO.1: Illustrate Elements of Information Security. 2304424L.CEO.2: Identify the different tools for footprinting.

2304424L.CEO.3: Identify different types of vulnerabilities and vulnerability Assessment Tools and Techniques.

2304424L.CEO.4: Identify different web servers, web applications attacks and countermeasures.

2304424L.CEO.5: Understand mobile and wireless applications to identify potential security vulnerabilities.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304424L.CO.1: Apply different approaches to perform Footprinting through search engines, web, and network sites [L3].

2304424L.CO.2: Apply different scanning tools to identify the host, port, and services of the target system [L4].

2304424L.CO.3: Analyze the vulnerabilities in a given application using appropriate tools [L4].

2304424L.CO.4: Identify and exploit vulnerabilities in web applications that allow malicious SQL queries, to gain unauthorized access [L3].

2304424L.CO.5: Examine security vulnerabilities in mobile and wireless applications [L4].

**COURSE ABSTRACT:**

The Ethical Hacking Lab Course provides hands-on experience in identifying, exploiting, and mitigating cybersecurity vulnerabilities. Participants use real-world tools and techniques to conduct penetration testing, vulnerability assessments, and simulated attacks on networks, systems, and web applications. The course emphasizes ethical hacking principles, legal considerations, and developing skills to safeguard organizational assets from malicious threats. Through practical exercises, learners gain proficiency in offensive and defensive cybersecurity strategies, preparing them for roles in ethical hacking, network security, and incident response.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Foot printing and Reconnaissance.** | **4 HOURS** |
| Perform footprinting on the target network/system using search engines, web services, and social net- working sites. | | |
| **PRACTICAL NO.02** | **Network Scanning.** | **4 HOURS** |
| 1) Perform host, port, service, and OS discovery on the target network 2) Perform scanning on the target network beyond IDS and Firewall | | |
| **PRACTICAL NO.03** | **Vulnerability Assessment.** | **4 HOURS** |
| Perform vulnerability assessment using various vulnerability assessment tools and analyze the vulner- able reports. | | |
| **PRACTICAL NO.04** | **Web Application Attacks.** | **4 HOURS** |
| 1) Sniffing: ARP poising using arpspoofing 2) Social Engineering 3) DoS or Session Hijacking . | | |
| **PRACTICAL NO.05** | **Hacking Web Servers.** | **4 HOURS** |
| 1) Perform Privilege Escalation to Gain Higher Privileges 2) Perform Web Cache Poisoning Attack | | |
| **PRACTICAL NO.06** | **Hacking Web Application.** | **4 HOURS** |
| 1) Perform SQL Injection and SQL Map 2) Perform a brute force attack for password cracking 3) Perform Cross Site Request forgery (CSRF) attack . | | |
| **PRACTICAL NO.07** | **Hacking Wireless Networks.** | **2 HOURS** |
| 1) Crack a WEP Network using Wifiphisher 2) Crack a WEP Network using Aircrack-ng | | |
| **PRACTICAL NO.08** | **Hacking Mobile Platforms.** | **2 HOURS** |
| SMS Phishing attack (SMishing) | | |

**TEXT BOOKS**

Ethical Hacking and Countermeasures V11, Professional Series by EC-Council

Hacking: The Art of Exploitation, 2nd Edition by Jon Erickson

**REFERENCE BOOKS**

The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, 2nd Edition by Dafydd Stuttard and Marcus Pinto.

Gray Hat Hacking The Ethical Hackers Handbook, 3rd Edition" by Allen Harper and Shon Harris

**E-RESOURCES**

https://nptel.ac.in/courses/106105217

https://tryhackme.com/r/hacktivities/practice

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | PROJECT MANAGEMENT |
| | COURSE CODE | 2304476T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** Software Engineering

**COURSE OBJECTIVES :**

2304476T.CEO.1: Explore various project management tools to track project progress. 2304476T.CEO.2: Illustrate project risks and challenges specific to software projects. 2304476T.CEO.3: Apply effective communication and collaboration strategies in teams. 2304476T.CEO.4: Evaluate project success using established metrics.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304476T.CO.1: Demonstrate a comprehensive understanding of core project management concepts [L2].

2304476T.CO.2: Apply knowledge to create detailed project plan that ensures the project goals are met [L3].

2304476T.CO.3: Apply the key knowledge areas and processes involved in project management [L3].

2304476T.CO.4: Identify key components of the risk management process and assess project risks through various project phases [L4].

**COURSE ABSTRACT:**

Project Management course for final year Computer Engineering students covers essential principles and practices. It begins with foundational concepts and the importance of project management, then explores planning and control systems, including tools like Gantt charts and work breakdown structures. Students also learn cost estimation, budgeting, and risk management processes. Additionally, the course addresses project quality management and organizational behavior, focusing on quality assurance and stakeholder engagement. Finally, it examines the corporate context, including maturity models and international project challenges. Through theory and case studies, students gain skills to effectively lead engineering projects in a dynamic environment.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **BASICS OF PROJECT MANAGEMENT** | **06 HOURS** |

**Applications/Case Study:** EcoBuild Construction Projects.
**Contents:** Introduction, SMART Project, Knowledge Areas and Processes, Project Manager respon- sibilities, Phases of Project Management Life Cycle, Project environments, Impact of Delays in Project Completions.
**Self Study:** Monitoring and Controlling (Life cycle Phase).
**Further Readings:** Agile methodologies.

| | | |
|---|---|---|
| **UNIT 2** | **SYSTEMS AND PROCEDURES FOR PLANNING AND CON- TROL** | **06 HOURS** |

**Applications/Case Study:** GreenVille Urban Development Project.
**Contents:** Project: Types, Master Plan, Charter, Organization and Responsibilities. Networks Dia- grams, The Critical Path, Gantt Charts and Calendar Schedules, CPM, PERT (Project Management Tools: Gantt Project, OpenProj).
**Self Study:**Work Breakdown Structure (WBS).
**Further Readings:**Asana ((Project Management Tool).

| | | |
|---|---|---|
| **UNIT 3** | **COST ESTIMATING,BUDGETING AND RISK MANAGE- MENT** | **06 HOURS** |

**Applications/Case Study:** Skyline Residential Complex.
**Contents:** Cost Estimating and Cost Escalation: Process, Elements of Budgets and Estimates. Risk Management: process, Phases, Assessment, Response Planning, Tracking and Response.
**Self Study:** SWOT Analysis (Risk Management Phase).
**Further Readings:**e-Builder (Cost Estimation tool).

| UNIT 4 | PROJECT QUALITY MANAGEMENT AND ORGANIZA- TION BEHAVIOR | 06 HOURS |
|---|---|---|

**Applications/Case Study:** TechNova Software Development Project.
**Contents:**Concept of Quality, Processes of Project Quality Management, Techniques for Quality As- surance during System Development, Stakeholders, Managing Participation, Teamwork and Conflict. **Self Study:** Quality Planning ( Quality Management) .
**Further Readings:**Trello ( web-based project management tool).

| UNIT 5 | CORPORATE FRAMEWORK | 06 HOURS |
|---|---|---|

**Applications/Case Study:** GlobalTech Innovations.
**Contents:** Project Management Maturity and Maturity Models, Knowledge and Time Management, International Projects and associated problems, Entrepreneurs and Startup.
**Self Study:** CMMI (Maturity Model). .
**Further Readings:** Maturity Models in Agile Environments. .

**TEXT BOOKS**

John M. Nicholas and Herman Steyn *Project Management for Business, Engineering, and Tech- nology*. 7th Edition 3, ELSEVIER ISBN: 978-0-7506-8399-9.

George Ellis *Project Management in Product Development*. 7th Copyright c 2016 Elsevier Inc, ISBN: 978-0-12-802322-8.

**REFERENCE BOOKS**

Russ J. Martinelli, Dragan Z. Milosevic. *Project Management Toolbox*. 13th Wiley Copyright 2018, ISBN 978-1-118-97312-7.

Kalpesh Ashar. *Project Management Essentials You Always Wanted To Know*. vibrant publishers.

Christine Petersen. *The Practical guide to Project Management*. Edition 1 ISBN 978-87-403-0524-1.

John M. Preston. *Beginning Project Management* .

Russell W. Darnall, John M. Preston. *Project Management from Simple to Complex*. The Open University of Hong Kong .

**E-RESOURCES**

https://onlinecourses.nptel.ac.in/noc24 mg01/preview.

https://www.coursera.org/specializations/project-management

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Major Project - III |
| | COURSE CODE | 2304491L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304491.CEO.1: To understand how to carry out performance evaluation and comparative analysis in appropriate form.

2304491.CEO.2: To know about standard industry practices.

2304491.CEO.3: To become familiar with the steps involved in identifying and selecting a good platform to present the work done.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304491.CO.1: Make use of standard industry practices [L3].

2304491.CO.2: Interpret the findings and compare them with the results in the literature [L5].

2304491.CO.3: Identify weaknesses and limitations in the findings and propose improvements [L3].

2304491.CO.4: Function as a team and communicate the work done by adhering to the norms of professional ethics [L4].

**COURSE ABSTRACT:**

The project is most important part of undergraduate curriculum and enables students to develop an alytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The ob- jective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effective- ness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Major Project - I, Major Project - II and Major Project - III. After successful completion of Major Project - II (Sem VI), next step is Ma- jor Project - III (Sem VII). The goal of this phase of the project is to draw Inferences and Detail Analysis/Final Testing/Re-development/etc. Showcasing the work - Technical documentation in Con- ferences/Journal/Patent/Product/Working model.

**GUIDELINES**

g) Project group students of Sem VI would be continued in this semester VII.

h) The group members may be from different programs to support the interdisciplinary functioning.

i) Projects should preferably have a national/international, industry/academic/research collabora- tion.

j) Students should do extended implementation of their project in consultation with their advisor.

k) For extended implementation, objectives of Sem V and Sem VI should have been already achieved.

l) Every project should follow at least one standard industry practice while implementing. For example, below are some of the standard industry practices followed by Electrical engineers:

- If writing a Matlab code, follow **MathWorks Advisory Board (MAB)** Guidelines
- For embedded c coding, **Motor Industry Software Reliability Association (MISRA)** standards can be used
- If antenna is manufactured, then get **EMI/EMC** testing certificate from National Accred- itation Board for Testing and Calibration Laboratories.

m) Performance evaluation and Comparative analysis of results should be carried out and presented in appropriate form.

n) Carry out detail analysis to improve performance w.r.t Final Testing/Re-development/etc.

o) Showcase the work in Conferences/Journal/Patent/Product/Working model.

**Note:** *For guideline 6, every DEPARTMENT should identify standard industry practices and*

*try to incorporate in the projects.*

## ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

10. Project Review I (Internal): (10 Marks)
11. Activity (Standard industry practices): (5 Marks)
12. Project Review II (External): (10 Marks)
13. Project Report: (5 Marks)
14. Every project group should publish paper in National conference / International conference / Participate in technical project competition (with achievement) / File a patent/etc.: (5 Marks)
15. Project: Final Presentation and Demonstration (External) (40 Marks)

**Note:**

- Report should be prepared in LATEX.
- External examiner for Review 2 and Final Demo should be allocated same group.
- Report will be jointly evaluated by External examiner and Internal examiner.

## REFERENCES


Eng-Choon Leong et al (2015). Guide To Research Projects For Engineering Students. CRC press, Apple Academic Press Inc. ISBN: 9781482238778, 9781482238778.

Michelle Reid (2018). Report Writing (Pocket Study Skills). Second Edition, Macmillan Education.

Leslie Lamport (2011). A Document Preparation System LATEX: User's Guide and Reference Manual. Pearson.


## E-RESOURCES

IEEE Author Center

Intellectual Property India - Indian Patent Office

FlowingData

Design and Analysis of Experiments

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Research Methodology |
| | COURSE CODE | 2304492T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304492.CEO.1: To enable defining and formulating research approaches towards obtaining solutions to practical problems.

2304492.CEO.2: To facilitate development of scientific oral and written communication skills.

2304492.CEO.3: To comprehend the concepts behind adhering to scientific ethics and values.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304492.CO.1: Apply the key concepts of research methodology to provide real world solutions [L3].

2304492.CO.2: Analyze the research problems and results to evaluate the methodologies, identify limitations, and draw conclusions [L4].

2304492.CO.3: Apply scientific writing skills for preparing dissertation, research articles and research proposals [L3].

2304492.CO.4: Evaluate the ethical implications of the use of artificial intelligence tools in research, focusing on issues such as data privacy, algorithmic bias, transparency, accountability, and responsible use of AI to ensure fairness and integrity in

**COURSE ABSTRACT:**

Research methodology is a structured and scientific approach used to collect, analyze, and interpret quantitative or qualitative data to answer research questions or test hypotheses. A research methodology is like a plan for carrying out research and helps keep researchers on track by limiting the scope of the research. Several aspects must be considered before selecting an appropriate research methodology, such as research limitations and ethical concerns that may affect your research

A research methodology describes the techniques and procedures used to identify and analyze informa- tion regarding a specific research topic. It is a process by which researchers design their study so that they can achieve their objectives using the selected research instruments. It includes all the important aspects of research, including research design, data collection methods, data analysis methods, and the overall framework within which the research is conducted. While these points can help you understand what is research methodology, you also need to know why it is important to pick the right methodology.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **Introduction to Research methodology** | **6 HOURS** |
| **Contents:** Meaning of research, Types of research, Research process, Problem definition, Objectives of research, Research questions, Research design, Approaches to research, Quantitative vs. qualitative approach, Understanding theory, Building and validating theoretical models, Exploratory vs. confir- matory research, Experimental vs theoretical Research, Importance of reasoning in research. | | |
| **UNIT 2** | **Problem formulation** | **8 HOURS** |
| **Contents:** Problem formulation, Conducting literature review, Referencing, Information sources, Information retrieval, Role of libraries in information retrieval, Tools for identifying literatures, Indexing and abstracting services, Citation indexes. | | |
| **UNIT 3** | **Result Analysis** | **6 HOURS** |
| **Contents:** Experimental research, Cause effect relationship, Development of hypothesis, Measurement systems analysis, Error propagation, Validity of experiments , Statistical design of experiments , Field experiments, Data/Variable types & classification, Data collection, Numerical and graphical data analysis, Sampling, Observation, Surveys, Inferential statistics and interpretation of result. | | |
| **UNIT 4** | **Scientific Writing** | **4 HOURS** |
| **Contents:** Preparation of dissertation, research papers and proposals, Tables and illustrations, Guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript, References, citation, and listing system of documents. Ethics of Research, Scientific Misconduct, Forms of Scientific Misconduct. Plagiarism, Unscientific practices in thesis work, IPR: To give an idea about IPR, registration, patents,copyrights, and its enforcement. | | |
| **UNIT 5** | **Artificial Intelligence Tools & Ethics in Research** | **4 HOURS** |

**Contents:** Role of AI in modern research practices, AI Tools for Data Collection and Analysis, Ethical Considerations in AI for Research, AI, Research Integrity, and Bias, Responsible Use of AI in Research, Future Trends in AI and Research Ethics, NITI Aayog National Strategy for Artificial Intelligence.

**TEXT BOOKS**

C. R. Kothari (2023). Research Methodology. New Age International Publishers, Fifth Edition, ISBN: 978-9389802559.

Ranjit Kumar (2024). Research Methodology: A Step by Step Guide for Beginners. SAGE Publications, Fourth Edition, ISBN: 978-9351501336.

**REFERENCE BOOKS**

Shanti Bhushan Mishra, Shashi Alok (2017). Handbook of Research Methodology. Educreation, First Edition, ISBN: 978-1-5457-0340-3.

Chandra Vinod, Hareendran Anand (2017). Research Methodology. Pearson Education, First Edition, ISBN:978-9352863518.

**E-RESOURCES**

National Strategy for Artificial Intelligence

AI Standards & Policies

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Summer Internship (Technical) |
| | COURSE CODE | 2304496L |
| | COURSE CREDITS | 4 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | NIL | 150 | 150 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2304496L.CEO.1: To enhance technical skills and self-directed learning.

2304496L.CEO.2: To develop adaptability and resilience in a multicultural or professional environment. product/system/software.

2304496L.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2304496L.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2304496L.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304496L.CO.1: Analyse the organizational structure and workflow of a professional setup to identify opportunities for optimization and innovation [L4].

2304496L.CO.2: Design innovative products, systems, or software by integrating interdisciplinary knowledge and addressing real-world challenges [L5].

2304496L.CO.3: Collaborate effectively within multidisciplinary teams to achieve project objectives, demonstrating strategic decision-making and problem-solving skills [L4].

2304496L.CO.4: Evaluate industry-relevant practices through hands-on experience, enhancing profes- sional competence and adaptability [L4].

2304496L.CO.5: Formulate comprehensive and innovative engineering problem statements by synthe- sizing technical knowledge and industry insights [L4].

2304496L.CO.6: Analyze project feasibility using cost estimation,

**INTRODUCTION**

The Student Internship Program (SIP) aims to empower final-year entrants B.Tech. students by providing them with valuable opportunities to engage with industry and academic centers of excellence. Through SIP, students gain comprehensive practical experience that bridges the gap between classroom learning and real-world application.

The program is designed to cultivate professionalism, enhance networking capabilities, and strengthen academic and professional skills, ensuring students are well-prepared for the demands of today's competitive global market. By participating in internships, students can apply their academic knowledge in professional settings, fostering a deeper understanding of their field and equipping them with the expertise needed to excel in their future careers.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the final year of the B.Tech. program, to be undertaken during the summer break after Semester VI. This program aims to provide opportunities for skill enhancement through industrial internship or research internship exposure. The internship focuses on helping students identify and engage with relevant MNC, medium scale enterprise, or small-scale industries, or research organization to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

d) **Duration:** : 4 to 8 weeks (minimum of 160 hours).

e) **Timeframe:** Conducted during June-July of each academic year.

**f)Nature of Internship:**

e) Industrial internship with MNC or medium-scale industries.

f) Research internship in the CSIR lab or DRDO / IIT / IISc / NCL / NEERI etc

• **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.

• **Mentorship:** Each third-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development. **Student Development Focus :**

Before selecting an internship option, second-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures reg- ular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

---

**Continuous Assessment (CA): Biweekly Progress Reports and interaction with faculty mentor (40%):**

Students must submit at least two progress reports during the internship/training period. Each report should clearly document:

Activities performed

Skills or concepts learned

Challenges faced and strategies used to overcome them

**Detailed Project Report with Learning Outcomes (30%)**

Upon completion of the internship, students are required to submit a comprehensive minimum of 30 to 40 pages' internship/project report. The report must include:

Overview of the Industry/Research Institute

Skills and knowledge acquired (technical).

Specific challenges addressed

Personal and professional growth reflections

Clearly stated learning outcomes

The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certificate (30%):**

Students will deliver a final presentation summarizing their internship experience and learning outcomes.

A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | CYBER SECURITY |
| | COURSE CODE | 2304412T |
| | COURSE CREDITS | 4 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 4 | NIL | 60 | NIL | 90 | NIL | NIL | 150 |

**PREREQUISITE :** COMPUTER NETWORK

**COURSE OBJECTIVES :**

2304412T.CEO.1: Introduce foundational cybersecurity concepts including threats, vulnerabilities, en- cryption, and ethical hacking methodologies.

2304412T.CEO.2: Equip learners with practical knowledge of securing network infrastructure and end- points

2304412T.CEO.3: Enable students to apply AI and ML techniques for threat detection and defense

2304412T.CEO.4: Integrate computer vision approaches for malware and anomaly detection.

2304412T.CEO.5: Understand and implement IoT security and communication protocols. 2304412T.CEO.6: Explore and apply cloud security best practices in real-world contexts.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304412T.CO.1: Explain core cyber security principles and apply incident response strategies. [L3].

2304412T.CO.2: Demonstrate hands-on ability to secure networks and systems [L3].

2304412T.CO.3: Apply AI/ML models for threat detection and defense against adversarial attacks [L3].

2304412T.CO.4: Implement computer vision for malware detection and biometric access control [L3].

2304412T.CO.5: Design and secure IoT infrastructures addressing vulnerabilities and privacy [L3].

2304412T.CO.6: Apply cloud security tools and practices to prevent misconfigurations and data leaks [L3].

**COURSE ABSTRACT:**

This course offers a deep dive into modern cybersecurity, covering foundational principles, network defenses, AI-driven threat detection, computer vision security, IoT protection, and cloud security. Through real-world case studies and hands-on labs, students learn to analyze attacks, secure systems, and apply cutting-edge tools and techniques. Emphasis is placed on practical skills in threat modeling, adversarial AI, steganography, and secure cloud configurations. By the end of the course, learners will be equipped to build and manage resilient, intelligent, and secure digital environments.

**THEORY COURSE CONTENTS**

| UNIT 1 | FOUNDATIONS OF CYBERSECURITY | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Dissection of the SolarWinds supply chain attack — mapping attack vectors and response strategies.

**Contents:Introduction to Cybersecurity:** Basic concepts, threats, vulnerabilities, and security principles. **Data Security:** Data encryption, access control and data loss prevention.**Application Security:** Secure development practices, input validation.**Ethical Hacking:** Understanding how at- tackers think and testing security measures. **Incident Response:** Procedures for handling security breaches. **Lab:** Network analysis using Wireshark and threat modeling with STRIDE

**Self Study:** History of major cyber attacks (e.g., Stuxnet, Equifax breach) ,CIA Triad

**Further Readings:** Advanced Persistent Threats (APT), Security Information and Event Manage- ment (SIEM)

| UNIT 2 | NETWORK AND SYSTEM SECURITY | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Analysis of the Dyn DNS DDoS attack via IoT devices — securing endpoints and networks.

**Contents:** Firewalls, IDS/IPS, Zero Trust Architecture. Common attacks: DDoS, Man-in-the-Middle (MITM), Endpoint security and patch management

**Lab:** Simulate DDoS using LOIC, firewall configuration

**Self Study:**Packet inspection and protocol layers (OSI model), Network segmentation and VLANs

**Further Readings:**Intrusion Detection Using Deep Learning,Software-Defined Perimeter (SDP).

| UNIT 3 | INTELLIGENT SECURITY SYSTEMS: AI TECHNIQUES | 10 HOURS |
|---|---|---|

**Applications/Case Study:**Attacking an image classifier with adversarial inputs — evasion and mit- igation techniques.

**Contents:AI and ML Fundamentals:** Understanding machine learning algorithms, neural net- works, and other AI techniques. **AI-Driven Threat Detection:** Using AI to identify and prevent malicious activity. **Anomaly Detection**: Detecting unusual patterns in network traffic or system behaviour.**Adversarial AI:** Understanding how AI models can be manipulated and how to defend against adversarial attacks.**AI-Powered Security Solutions:** Exploring various AI-based security tools and technologies. **Lab:** Perform an FGSM adversarial attack on a CNN model using PyTorch or TensorFlow

**Self Study:** Basics of supervised vs unsupervised learning, Confusion matrix and ROC curves for model evaluation, Adversarial example generation techniques

**Further Readings:**Explainable AI (XAI) for Cybersecurity, Transfer Learning in Threat Detection.

| UNIT 4 | SECURING SYSTEMS WITH COMPUTER VISION | 10 HOURS |
|---|---|---|

**Applications/Case Study:**Multi-Layered Threat Detection and Access Control Using Computer Vision Techniques.

**Contents: Computer Vision Fundamentals:**Understanding image processing, object recognition, and machine vision techniques. **Malware Detection in Images:** Using computer vision to identify malware embedded in images, especially in phishing emails. **Image-Based Anomaly Detection:** Using computer vision to detect unusual patterns in visual data, like network traffic or video footage. **Facial Recognition for Access Control:** Implementing facial recognition systems for secure access to physical and digital environments.

**Lab:** Malware Detection in Images (Steganography Analysis)

**Self Study:** Image classification vs object detection, Common CV architectures (e.g., CNNs, YOLO, ResNet), Introduction to steganography and digital watermarking

**Further Readings:**Deepfake Detection Techniques, Vision-Based Behavioral Biometrics, 3D Facial

Recognition and Spoofing Countermeasures

| UNIT 5 | BUILDING RESILIENT IOT SYSTEMS | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Exploiting the Mirai botnet — understanding how unsecured IoT devices are hijacked.

**Contents: IoT Security Fundamentals:** Understanding the vulnerabilities of IoT devices and net- works. **Securing IoT Devices:** Implementing security measures for IoT devices, including authen- tication, encryption, and intrusion detection.**IoT Network Security:** Securing the communication channels and protocols used by IoT devices. **Data Privacy in IoT:** Addressing privacy concerns related to the collection, storage, and use of data from IoT devices. **IoT Device Security Manage- ment:** Managing the security of a large number of IoT devices.

**Lab:** Firmware extraction and basic analysis using Binwalk; scan IoT devices via Shodan

**Self Study:** IoT protocols: MQTT, CoAP. Common IoT OS platforms: RIOT, Contiki.Device hard- ening and secure boot

**Further Readings:** Secure Boot and Trusted Execution Environment (TEE),Blockchain for IoT Se-
curity and Authentication, AI-Powered Intrusion Detection for IoT Networks.

| UNIT 6 | CLOUD AND QUANTUM SECURITY | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Case of Uber's S3 bucket data leak — how misconfigurations led to massive data exposure.

**Contents:** Introduction to Cloud Computing, Types of Cloud Computing : Public, Private and Hy- brid, Cloud service models (IaaS, PaaS, SaaS), Identity Access Management (IAM), encryption, audit logs, **Cloud security tools:** AWS Inspector, GCP Security Command Center.**Quantum Comput- ing and Security:**Overview of Quantum Computing fundamentals,Threats to classical encryption by quantum algorithms (e.g., Shor's algorithm),Post-quantum cryptography and future-safe cryptographic standards.

**Lab:** Implement RBAC and encryption in AWS free tier **Self Study:**Cloud misconfiguration risks and prevention, IAM policies and RBAC vs ABAC. Cloud-native threat modeling

**Further Readings:** Cloud Security Posture Management (CSPM).

**TEXT BOOKS**

William Stallings, Lawrie Brown (2018).*Computer Security: Principles and Practice.* 4th Edition, Pearson. ISBN: 9780134794105.

Mark Stamp (2020). Information Security: *Principles and Practice*. 3rd Edition, Wiley. ISBN: 9781119570485.

Al-Sakib Khan Pathan (2016). *Security of Internet of Things: Challenges and Solutions*. CRC Press. ISBN: 9781138031784.

Tim Mather, Subra Kumaraswamy, Shahed Latif (2009). *Cloud Security and Privacy*. O'Reilly Media. ISBN: 9780596802769.

**REFERENCE BOOKS**

Clarence Chio, David Freeman (2018). *Machine Learning and Security: Protecting Systems with Data and Algorithms*. O'Reilly Media. ISBN: 9781491979907.

William Stallings (2013). *Network Security Essentials: Applications and Standards.* 4th Edition, Pearson. ISBN: 9780133370430.

Mohamed Elgendy (2020). *Deep Learning for Vision Systems. Manning Publications.* ISBN: 9781617296192.

Bruce Schneier (2015).*Applied Cryptography: Protocols, Algorithms, and Source Code in C*. 20th

**E-RESOURCES**

OWASP (Open Web Application Security Project) – https://owasp.org

Shodan (IoT Device Search Engine) – https://www.shodan.io

Wireshark Official Documentation – https://www.wireshark.org/docs/

AWS Security Documentation – https://docs.aws.amazon.com/security

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY DEPARTMENT OF ARTIFICIAL INTELLIGENCE | COURSE NAME | Semester Long Internship Program (SLIP) |
| | COURSE CODE | 2304497L |
| | COURSE CREDITS | 8 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | 150 | 150 | 300 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2304497L.CEO.1: To get acquainted with the organization structure

2304497L.CEO.2: To gain learning and living experience 2304497L.CEO.3: To develop appropriate workplace attitudes

2304497L.CEO.4: To get Hands-on experience in the related field to relate and reinforce what has been taught at the university

2304497L.CEO.5: To formulate the problem statement

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304497L.CO.1: Analyze real-world engineering problems and propose effective solutions using domain- specific knowledge [L4].

2304497L.CO.2: Evaluate suitable problem-solving methodologies and modern tools to address practi- cal engineering challenges [L5].

2304497L.CO.3: Demonstrate the ability to work effectively in cross-cultural and multidisciplinary teams within a professional environment [L4].

2304497L.CO.4: Develop and demonstrate teamwork, leadership, and communication skills required for collaborative and individual tasks [L4].

2304497L.CO.5: Apply ethical principles and commit to professional responsibilities and norms in en- gineering practice [L3].

2304497L.CO.6: Demonstrate awareness of the need for, and engage in, independent and lifelong learn- ing to remain relevant in technological and professional

**INTRODUCTION**

The Final-Year Semester-long internship program is structured to provide B.Tech. students with extended, in-depth exposure to real-world industrial environments and academic centers of excellence. Spanning 4 to 6 months, this internship serves as a vital bridge between academic coursework and professional practice, enabling students to apply theoretical knowledge to complex, practical challenges.

Through sustained engagement in industry settings, students develop critical technical compe- tencies, professional ethics, and workplace readiness. The program nurtures a sense of responsibility, fosters independent thinking, and sharpens problem-solving and project management skills. It also enhances students' ability to collaborate in multidisciplinary and multicultural teams, preparing them for dynamic, global work environments.

By immersing themselves in live projects, students gain hands-on experience, expand their pro- fessional network, and build the confidence and expertise necessary to transition seamlessly into their careers or pursue higher academic goals.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students the final year of the B.Tech. program, to be undertaken after Semester VII. This program aims to provide opportunities for skill enhancement through industrial internship or research internship exposure. The internship focuses on helping students identify and engage with relevant MNC, medium scale enterprise, or small-scale industries, or research organization to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

(C) **Duration:** 16 to 24 weeks.

(D) **Timeframe:** Conducted during Jan-June of each academic year.

**(E) Nature of Internship:**

5. Industrial internship with MNC or medium-scale industries.
6. Research internship in the CSIR lab or DRDO / IIT / IISc / NCL / NEERI etc

• **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.

• **Mentorship:** Each final-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development. **Student Development Focus :**

Before selecting an internship option, final-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures reg- ular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

**6. Continuous Assessment (CA): (Biweekly Progress Reports, Faculty Mentor Interaction Mid-Term Review) (50%)**

Students must submit biweekly progress reports during the internship period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them
- Regular interaction with the assigned faculty mentor is expected for guidance and monitoring. **A mid-term review will be conducted between the 8th and 12th week of the internship**. This review will evaluate the student's progress, alignment with learning objectives, and address any critical feedback for improvement. It will be considered as part of the CA component.

**7. Detailed Project Report with Learning Outcomes (20%)**

Upon completion of the internship, students are required to submit a comprehensive internship/project report (minimum 40 to 60 pages) which should include:

9. Overview of the Industry/Research Institute
10. Skills and knowledge acquired (technical).
11. Specific challenges addressed,
12. Reflections on personal and professional growth
13. Clearly articulated learning outcomes
14. The report will be assessed for depth, relevance, structure, and clarity.

**8. Final Presentation with Certificate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: (Rev. 2023(NEP)) |
| FINAL YEAR BACHELOR TECHNOLOGY | COURSE NAME | Capstone Portfolio |
| | COURSE CODE | 2304493L |
| | COURSE CREDITS | 08 |
| RELEASE DATE : | REVISION NO. | NEP 1.0 |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 16 | NIL | NIL | NIL | 150 | 150 | 300 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304493.CEO.1: Identify solutions at different scales, ensuring sustainability within diverse engineer- ing contexts.

2304493.CEO.2: Develop a capstone project or research internship problem adhering to standard engineering practices with precision and accuracy.

2304493.CEO.3: Organize artifacts and results through teamwork and effective communication under project or research internship constraints.

2304493.CEO.4: Synthesize findings into a reflective report that communicates results with profes- sional ethics.

2304493.CEO.5: Create a professional portfolio showcasing achievements and growth aligned with engineering standards.

2304493.CEO.6: Justify progressive growth in a portfolio, highlighting contributions to sustainability and teamwork.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304493.CO.1: To Analyze capstone research work and find sustainable solutions in diverse engineering contexts. [L4]

2304493.CO.2: To Design a capstone research work using methodologies aligned with engineering standards. [L4]

2304493.CO.3: To Compile artifacts and outcomes collaboratively within project or research internship constraints. [L3]

2304493.CO.4: To Evaluate findings and prepare a reflective report adhering to ethical standards. [L5]

2304493.CO.5: To Create a digital personal portfolio in engineering practices. [L4]

2304493.CO.6: To present portfolio and graduation book reflecting contributions to sustainability and teamwork. [L4]

**COURSE ABSTRACT:**

The capstone project is an individual, self-identified endeavor focusing on technical or non-technical challenges. It emphasizes risk-taking, high productivity, strong design research, and the creation of ad- vanced solutions through innovative methodologies. Students are empowered to choose their projects, formulate solutions, negotiate deliverables, and work independently, culminating in a digital presen- tation. The capstone experience fosters critical thinking, problem-solving, and adaptability, aligning with professional engineering practices and research standards. A research internship complements this by exposing students to real-world applications of their skills, strengthening their ability to address complex challenges, and enhancing their professional preparedness. Together, the capstone project and internship provide a comprehensive platform for students to demonstrate their technical acumen and research capabilities. The digital portfolio and graduation book integrate these experiences into a co- hesive collection of work that reflects the evolution of skills and ideas. Combining written and visual content, it showcases critical thinking, design processes, and final artifacts. Students craft a professional voice through reflective articles, personal design philosophies, and enhanced online profiles, such as on LinkedIn. This structured portfolio serves as a powerful tool to articulate achievements and establish a professional identity.

Capstone portfolio is divided into two section a) Capstone Research work b) Digital Portfolio

**CAPSTONE RESEARCH WORK :**

Individual student can choose the topic from one of the below capstones to carry out the work during the entire semester

7. Technical Capstone
    - Industry identified problem
    - Institute identified problem
    - Urban city identified problems
    - Rural Development
    - Environmental related problems
    - Student Conceived problems
    - Satisfactory solution to Open ended problems
    - Innovative Design stemming from Student/Faculty
    - Product Development
    - App/ Software Development
    - Multidisciplinary approach to existing problem
    - Modeling/Optimization/Analysis study
8. Writing Intensive Capstone
    - Design
    - Literature Survey
    - Commercial Survey
    - Social media Survey
    - Idea/ Design Philosophy
    - Research Methodology
    - Consultancy Project work
    - Collaborative Project work
    - Laboratory/Digital classroom
    - Manage/lead any Event/activity
9. TechFrontier Capstone
    - State of art
    - Challenges and Prospect of Technology (Engineering) Education in Primary and Secondary DEPARTMENT s
    - Market Statistics

**DIGITAL PORTFOLIO :**

Individual student should create there own digital portfolio by using the standard professional platforms/blogs based on the record during their entire Under Graduate program. Digital portfolio should be professional, amalgamation of technical, written, graphical/Visual content and Verbal culmination of the skills and knowledge that students have developed over their under graduate program.

Process Portfolio

Show case Portfolio

Hybrid Portfolio

**GRADUATION BOOK :**

A graduation book is a comprehensive document showcasing students' achievements, projects, and reflections during their academic journey. It serves as a portfolio and a keepsake, reflecting their growth and accomplishments.

It should basically covered following content or c vtext

Personal Portfolio: Focused on an individual student's projects, awards, and career goals.

Class/Batch Book: Highlights collective achievements, group projects, and memorable moments of a graduating class.

Thematic Graduation Book: Centers on a specific theme, such as innovation, sustainability, or community impact, showcasing relevant work.

**GUIDELINES :**

4. Capstone Research Project: Each student is required to individually work on their capstone project throughout the semester, ensuring sustained focus and progress.
5. Title Approval: Students must propose a title for their capstone project, subject to approval by the Supervisor and DEPARTMENT Dean.
6. Scope of Work: The approved topic must be pursued with extensive research, accurate data, the necessary evidence, and measurable results.
7. Digital Portfolio: Students must independently create a digital portfolio to showcase their cap- stone work and overall growth.
8. Graduation book: Each student must authored a detailed graduation book documenting the capstone project, following plagiarism guidelines.
9. Alignment with Capstone Work: The research internship should complement the capstone project, reinforcing technical expertise, research methods, and professional skills.
10. Supervisor and Department Review: Capstone work and digital portfolios must be evaluated by the Supervisor and another faculty member from the department to ensure adherence to guidelines and quality standards.
11. Exemplary Performance Review: Exceptional capstone work may qualify for a secondary review, termed as ”Capstone Work Review 2,” to evaluate the student’s competency. Supervisors may request a concise report if the work is deemed remarkable. Examples of exemplary achievements include:
    - Published articles in Scopus-indexed journals.
    - Approved research proposals.
    - Wins in design competitions, technical fests, or workshops.
    - Wins in state, national, or international events (technical/non-technical).
    - Valid scores in competitive exams (e.g., GATE, CAT, GRE, TOEFL, IELTS).
12. Capstone and Portfolio Assessment: Both the capstone project and digital portfolio will undergo a formal review by the supervisor and department faculty.
13. Jury Examination: The final examination will be conducted in the presence of a jury panel to evaluate the student’s overall performance and competency.
14. Initiative and Ownership: Students are expected to take ownership of their work, from choosing the title to completing the capstone project and research internship independently.
15. Quality and Ethics: Work submitted must meet academic standards, demonstrating quality, originality, and ethical research practices.

**ASSESSMENT and EVALUATION :**

The Jury will be appointed to monitor the progress and continuous evaluation of each project. One of the members will be the Capstone Research work internship supervisor. The evaluation shall be performed jointly by the supervisor and the jury members.

Continuous assessment (150 marks)

Capstone Research work Review 1 (75 Marks)

Capstone Research work Review 2 (75 Marks)

Final Presentation and Demonstration (150 Marks)

Digital Portfolio and Graduation Book (75 Marks)

Capstone Research work Final demonstration (75 Marks)

**REFERENCES**


https://design.berkeley.edu/ Berkeley M.Des. University of California, U.S. .

://design.gatech.edu/ Georgia Institute of Technology, College of Design Atlanta, U.S.

https://www.apus.edu/ American Public University

https://msu.edu/ Michigan State University's US

https://www.cranfield.ac.uk Cranfield University, Shrivenham Swindon UK

https://my.bulbapp.com/personalized-learning/assessment-infographic-blog/

https://edtechjeffco.weebly.com

https://www.invisionapp.com/inside-design/10-portfolio-websites-to-show-off-your-design-


**E-RESOURCES**


https://www.canva.com/learn/design-digital-portfolio

https://www.adobe.com/in/express/create/online-portfolio

https://www.masterclass.com/articles/how-to-make-a-digital-portfolio .

https://issuu.com/solutions/design/portfolio

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Industry Practicum |
| | COURSE CODE | 2304499L |
| | COURSE CREDITS | 8 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | 150 | 150 | 300 |

**PRE-REQUISITE :** NIL

**COURSE OBJECTIVES :**

2304499L.CEO.1: To get acquainted with the organization structure

2304499L.CEO.2: To gain learning and living experience 2304499L.CEO.3: To develop appropriate workplace attitudes

2304499L.CEO.4: To get Hands-on experience in the related field to relate and reinforce what has been taught at the university

2304499L.CEO.5: To formulate the problem statement

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304499L.CO.1: Analyze real-world engineering problems and propose effective solutions using domain- specific knowledge [L4].

2304499L.CO.2: Evaluate suitable problem-solving methodologies and modern tools to address practi- cal engineering challenges [L5].

2304499L.CO.3: Demonstrate the ability to work effectively in cross-cultural and multidisciplinary teams within a professional environment [L4].

2304499L.CO.4: Develop and demonstrate teamwork, leadership, and communication skills required for collaborative and individual tasks [L4].

2304499L.CO.5: Apply ethical principles and commit to professional responsibilities and norms in en- gineering practice [L3].

2304499L.CO.6: Demonstrate awareness of the need for, and engage in, independent and lifelong learn- ing to remain relevant in technological and professional

**INTRODUCTION**

The Final-Year Semester-long internship program is structured to provide B.Tech. students with extended, in-depth exposure to real-world industrial environments and academic centers of excellence. Spanning 4 to 6 months, this internship serves as a vital bridge between academic coursework and professional practice, enabling students to apply theoretical knowledge to complex, practical challenges.

Through sustained engagement in industry settings, students develop critical technical compe- tencies, professional ethics, and workplace readiness. The program nurtures a sense of responsibility, fosters independent thinking, and sharpens problem-solving and project management skills. It also enhances students' ability to collaborate in multidisciplinary and multicultural teams, preparing them for dynamic, global work environments.

By immersing themselves in live projects, students gain hands-on experience, expand their pro- fessional network, and build the confidence and expertise necessary to transition seamlessly into their careers or pursue higher academic goals.

**SCOPE AND STRUCTURE OF SIP:**

**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the final year of the B.Tech. program, to be undertaken after Semester VI. This program aims to provide opportunities for skill enhancement through industrial internship or research internship exposure. The internship focuses on helping students identify and engage with relevant MNC, medium scale enterprise, or small-scale industries, or research organization to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

c. **Duration:** 16 to 24 weeks.

d. **Timeframe:** Conducted during August-December of each academic year.

**e. Nature of Internship:**

d. Industrial internship with MNC or medium-scale industries.

e. Research internship in the CSIR lab or DRDO / IIT / IISc / NCL / NEERI etc

• **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.

• **Mentorship:** Each final-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

**Internship Format and Personal Development Focus:**

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development. **Student Development Focus :**

Before selecting an internship option, final-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures reg- ular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

**c. Continuous Assessment (CA): (Biweekly Progress Reports, Faculty Mentor Interaction Mid-Term Review) (50%)**

Students must submit biweekly progress reports during the internship period. Each report should clearly document:

- Activities performed
- Skills or concepts learned
- Challenges faced and strategies used to overcome them
- Regular interaction with the assigned faculty mentor is expected for guidance and monitoring. **A mid-term review will be conducted between the 8th and 12th week of the internship**. This review will evaluate the student's progress, alignment with learning objectives, and address any critical feedback for improvement. It will be considered as part of the CA component.

**d. Detailed Project Report with Learning Outcomes (20%)**

Upon completion of the internship, students are required to submit a comprehensive internship/project report (minimum 40 to 60 pages) which should include:

d. Overview of the Industry/Research Institute

e. Skills and knowledge acquired (technical).

f. Specific challenges addressed,

g. Reflections on personal and professional growth

h. Clearly articulated learning outcomes

i. The report will be assessed for depth, relevance, structure, and clarity.

**e. Final Presentation with Certificate (30%):**

- Students will deliver a final presentation summarizing their internship experience and learning outcomes.
- A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | UI/UX DESIGN |
| | COURSE CODE | 2304364L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**~~PREREQUISITE KNOWLEDGE :~~**

**COURSE OBJECTIVES :**

2304364L.CEO.1: To apply the foundations of Human Computer Interaction.

2304364L.CEO.2: To Understand the design technologies for individuals and persons with disabilities.

2304364L.CEO.3: To apply the guidelines, principles and standards for user interface design.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304364L.CO.1: Identify human factors and usability issues related with computing applications. [L2].

2304364L.CO.2: Apply suitable design principles, models and usability guidelines for user interface design [L3].

2304364L.CO.3: Demonstrate the impact of usability evaluation and testing in computing applications [L2].

2304364L.CO.4: Design user interfaces using required processes and standards.[L6].

**COURSE ABSTRACT:**

UI/UX, which stands for User Interface/User Experience, is a course that focuses on creating intuitive, visually appealing, and user-friendly digital products and experiences. It combines principles from vari- ous disciplines such as design, human psychology,ergonomics and technology to enhance user satisfaction and engagement.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | | **4 HOURS** |
| Understanding Human Factors – Input Output Channels , Memory, Thinking, Emotions, Ergonomics. | | |
| **PRACTICAL NO.02** | | **4 HOURS** |
| Identifying Faulty Designs, Miller's Principle, Models of interactions- Norman's Action Model, Gulf of Execution and Evaluation, Errors – Mistakes, Slips, Lapses and Violations, | | |
| **PRACTICAL NO.03** | | **4 HOURS** |
| Understanding Design Process, Iterative Design, Navigation Design, Colors, Metaphors, Interaction Styles | | |
| **PRACTICAL NO.04** | | **4 HOURS** |
| UI design and elements current UI design patterns style guides and design systems material design and other design systems. | | |
| **PRACTICAL NO.05** | | **4 HOURS** |
| Identify specialized users and related facilities for a selected product or system and make necessary suggestions for its improved accessibility design. | | |
| **PRACTICAL NO.06** | | **4 HOURS** |
| Empathizing through Enquiry model to collect and listing of User and UX Requirements. | | |
| **PRACTICAL NO.07** | | **4 HOURS** |
| Design user persona for the users of selected product or system. | | |
| **PRACTICAL NO.08** | | **4 HOURS** |
| Conduct a contextual inquiry for selected product or system. | | |
| **PRACTICAL NO.09** | | **4 HOURS** |
| Design an interface prototype for selected product or system. | | |
| **PRACTICAL NO.10** | | **4 HOURS** |

| |
|---|
| Design an interface prototype for selected product or system (GOMS, GOEE). |

| | | |
|---|---|---|
| **PRACTICAL NO.11** | | **4 HOURS** |
| Design an interface prototype for selected product or system after Peer Expert Review 1. | | |
| **PRACTICAL NO.12** | | **4 HOURS** |
| Evaluate an interface using usability evaluation technique. | | |
| **PRACTICAL NO.13** | | **4 HOURS** |
| Evaluate an interface using usability evaluation technique. | | |
| **PRACTICAL NO.14** | | **4 HOURS** |
| Expert Evaluation – Cognitive walk through and User Based Evaluation | | |
| **PRACTICAL NO.15** | | **4 HOURS** |
| Demonstration and Justification of UI/UX Design (Conclusion) | | |

**TEXT BOOKS**

1. Alan Dix, Janet Finlay. (2004). *Human Computer Interaction*. 3rd Edition, Pearson publication ISBN 978-8131717035.

**REFERENCE BOOKS**

1. Ben Shneiderman. *Designing the User Interface*. 3rd Edition, Pearson publication . ISBN 978-8131721636.

**E-RESOURCES**

1. https://nptel.ac.in/courses/106106177

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **DEPARTMENT OF ARTIFICIAL INTELLIGENCE** | **W.E.F** | **AY:** 2026-2027 (Rev. 2023 (NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Major Project - I |
| | **COURSE CODE** | 2304391L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : 01/07/2025** | **REVISION NO.** | NEP |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304391.CEO.1: To equip students with the ability to conduct thorough literature reviews, identifying relevant academic and industry sources.

2304391.CEO.2: To introduce fundamental design principles and methodologies applicable to engineer- ing and technology projects.

2304391.CEO.3: To teach students the basics of creating models/designs to represent systems with modelling tools and software commonly used in industry and research.

2304391.CEO.4: To understand how simulation tool can be used for iterative design improvement and optimization.

2304391.CEO.5: To guide students how to communicate their project

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304391.CO.1: Apply mathematical, scientific, and engineering principles in the design and develop- ment of their projects [L3].

2304391.CO.2: Analyze, and solve complex engineering problems, demonstrating proficiency in research methodologies and modern tools [L4].

2304391.CO.3: Assess the societal and environmental impacts of their engineering solutions and incor- porate ethical considerations into their projects [L5].

2304391.CO.4: Communicate their project ideas and results effectively through presentations and re- ports, and work collaboratively in teams [L3].

2304391.CO.5: Apply effective project management skills, including planning, resource allocation, and adherence to timelines, while engaging in continuous

**COURSE ABSTRACT:**

The project is most important part of undergraduate curriculum and enables student's to develop an- alytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Project Design, Project Implementation and Project Evaluation. The first phase of Project Design mainly focuses on formulating system's requirement, background/literature review, and defining scope, objective and apply project management/modeling tools to design proposed solution. This enables students to apply their technical acumen and innova- tiveness in proposing methodology, milestones, and expected outcome.

**GUIDELINES**

3. Every project group should consist of minimum 03 and maximum of 04 students.
4. The group members may be from different programs to support the interdisciplinary functioning.
5. Project group members and title of the project need to be approved by Project Guide and DEPARTMENT .
6. Projects should preferably have a national/international industry/academic/research collabora- tion.
7. User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
8. The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.
9. Define proposed solution and apply project management/modeling tools for project planning and design.
10. Critically analyze various solutions/techniques to solve real world problems and perform feasibility study to select and justify proposed solution.
11. Define outcome, milestones, definite roadmap for project design, implementation, evaluation and documentation.

**Collaborative/Sponsored Project**

Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for project work.

Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization, anytime before the commencement of the sixth semester.

Proposed Collaborative Project work need to reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of minimum 12 months to 18 months.

Final assessment will be carried out in presence of faculty mentor, external mentor and examiner.

**TIMELINE**

c. Exploration of fore front research/specialization areas and opportunities in the various fields.

d. Formation of Project Group. Finalization of area of work/title as per forefront areas.

e. Exploration of abridged courses, valid resources, challenges, relevance with current opportunities.

f. Background study Systematic literature review.

g. Literature review documentation for Project Report and Research Article.

h. Project Review I Presentation.

i. Define problem statement and objectives.

j. Define scope of the work and Outline of the work.

k. Project Design, Modelling, Simulation etc.

l. Proposed Methodology of the solution and its documentation.

m. Project Review II Presentation.

n. Project Documentation: Ethics in Writing

o. Project Documentation: Final Synopsis

p. Project Documentation: Project Report Writing

**ASSESSMENT and EVALUATION**

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

Background Study and Literature Review (10 Marks)

Synopsis (5 Marks)

Project Review I: Problem Identification, Motivation, Relevance, Background Study, Literature Review (10 Marks)

Project Review II: Literature Review, Problem Definition, Project Planning, Analysis and Design (10 Marks)

Project Report (10 Marks)

Final Presentation and Demonstration (30 Marks)

**TEXT BOOKS**

John M. Nicholas. (2012). *Project Management for Engineering, Business and Technology*. 4th Edition, Butterworth-Heinemann. ISBN 978-0080967042.

Leslie Lamport. (1994). LaTeX: *A document preparation system, User's guide and reference manual*. 2nd Edition, Addison-Wesley. ISBN 978-0201529838.

**REFERENCE BOOKS**

Michelle Reid. (2018). *Report Writing (Pocket Study Skills)*. 2nd Edition, Bloomsbury Publishing. ISBN 978-0230376557.

Sara Efrat Efron and Ruth David. (2018). *Writing the Literature Review : A Practical Guide*. 1st Edition, Guilford Press . ISBN 978-1462536894 .

**E-RESOURCES**

IEEE Open Access Articles
Science Direct Open Access E-Journals
ASME Digital Collections
ASCE (American Society for Civil Engineers)
CSIR-NISCAIR E- journals
Spriger Open Access E-Journals & E-Journals
Shodh Gangotri (Repository of Indian Research in Progress)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Internship (Technical) |
| | COURSE CODE | 2304396L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | NIL | 75 | 75 |

**PRE-REQUISITE :** Knowledge about the communication skills

**COURSE OBJECTIVES :**

2304396.CEO.1: To enhance technical skills and self-directed learning.

2304396.CEO.2: To develop adaptability and resilience in a multicultural or professional environment.

2304396.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2304396.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2304396.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304396.CO.1: Apply technical competencies gained through hands-on training or certification pro- grams to solve discipline-specific engineering problems [L3].

2304396.CO.2: Develop professional behavior by demonstrating teamwork, time management, and eth- ical practices in technical and industrial environments [L5].

2304396.CO.3: Evaluate personal and professional growth through critical analysis of experiential learn- ing and industry training outcomes to support career planning [L5].

2304396.CO.4: Formulate strategies addressing emerging industry needs by integrating advanced tech- nical skills with real-world insights [L4].

2304396.CO.5: Propose solution-oriented approaches to complex problems using multidisciplinary knowledge and practical exposure [L5].

2304396.CO.6: Design and deliver technical presentations and detailed

**INTRODUCTION:**

This internship is designed to equip third year entrants B.Tech. students with essential skills for personal and professional growth. The program emphasizes cultivating professionalism, technical expertise, and real-world problem-solving capabilities, enabling students to thrive in competitive and dynamic landscape. Through this immersive experience, students will develop a comprehensive skill set that includes technical knowledge applied through real-time projects, effective communication, teamwork, and adaptability.

A significant focus of the program is encouraging students to pursue technical certifications in core and emerging domains, thereby enhancing their technical competence and industry readiness. These certifications include, but are not limited to:

3. **Programming and Development:** Java, Python, C++, and Advanced Java.
4. **Database Management:** Oracle, SQL, and MongoDB.
5. **Engineering Design and Simulation:** Autodesk Revit, MATLAB, ANSYS, and AutoCAD.
6. **Process Simulation and Optimization:** Aspen HYSYS, Aspen Plus, and CFD (Computational Fluid Dynamics).
7. **Data Analytics and Visualization:** Power BI, Tableau, and Excel Advanced Analytics.
8. **Cloud Computing and Automation:** AWS (Amazon Web Services), Microsoft Azure, and DevOps Essentials.
9. **AI and Machine Learning:** TensorFlow, PyTorch, and introductory courses in AI/ML appli- cations.
10. **Digital Tools for Productivity:** Primavera P6 for project management and SolidWorks for design engineering.

By participating in this internship, students will gain hands-on experience in their chosen technical areas, actively apply theoretical knowledge to practical challenges, and build confidence in delivering solutions. The program also emphasizes collaboration and peer learning, helping students to develop essential teamwork skills.

## SCOPE AND STRUCTURE OF SIP:

**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the third year of the B.Tech. program, to be undertaken during the summer break after Semester IV. This program aims to provide opportunities for skill enhancement through global certifications, technical skills training, or industrial exposure. The internship focuses on helping students identify and engage with relevant learning platforms, small-scale industries, or training opportunities to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

3. **Duration:** : 3 to 4 weeks (minimum of 100 hours).
4. **Timeframe:** Conducted during June-July of each academic year.
5. **Nature of Internship:**

7. Technical skills training programs.
8. Industrial training with companies or small-scale industries.
9. Certifications in core technical fields such as programming, database management, design, simula- tion, and data analysis.

• **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.

• **Mentorship:** Each second-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

## Internship Format and Personal Development Focus:

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development. **Student Development Focus :**

Before selecting an internship option, second-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. The program places significant emphasis on pursuing technical certification programs in areas such as programming, database management, engineering design, simulation, data analytics, and more. These certifications will enhance students' technical expertise and provide them with a competitive edge in the industry, preparing them for future academic and career success.

Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying these areas and selecting appropriate internship opportunities.

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures reg- ular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

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**Continuous Assessment (CA): Biweekly Progress Reports and interaction with faculty mentor (40%):**

Students must submit at least two progress reports during the internship/training period. Each report should clearly document:

Activities performed

Skills or concepts learned

Challenges faced and strategies used to overcome them

**Detailed Project Report with Learning Outcomes (30%)**

Upon completion of the internship, students are required to submit a comprehensive minimum of 20 to 25 pages' internship/project report. The report must include:

Overview of the Industry/Research Institute

Skills and knowledge acquired (technical/soft/life)

Specific challenges addressed

Personal and professional growth reflections

Clearly stated learning outcomes

The report will be assessed for depth, relevance, structure, and clarity.

**3. Final Presentation with Certificate (30%):**

Students will deliver a final presentation summarizing their internship experience and learning outcomes.

A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | SOFTWARE ENGINEERING |
| | COURSE CODE | 2304313T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 30 | 20 | 50 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Prototyping

**COURSE OBJECTIVES :**

2304313T.CEO.1: To explore the software process models.

2304313T.CEO.2: To process requirement engineering and modeling for product development.

2304313T.CEO.3: To estimate and manage software metrics.

2304313T.CEO.4: To understand the test driven environment in software development. 2304313T.CEO.5: To illustrate DevOps lifecycle and different tools

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304313T.CO.1: Classify SDLC process models.[L4]

2304313T.CO.2: Analyze conformance of the requirement and modeling related to project develop- ment.[L4]

2304313T.CO.3: Apply mitigation techniques for the risk associated with project development.[L3]

2304313T.CO.4: Evaluate the schedule, cost and staff associated with project. [L5] 2304313T.CO.5: Apply different DevOps tools for project development. [L3]

**COURSE ABSTRACT:**

The Software Engineering course provide preparation for careers in system development, project management, and quality assurance with cutting-edge tools and methodologies. Enhance technical skills and problem-solving abilities essential for top tech roles.

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **Basics of Software Engineering** | **08 HOURS** |

**Applications/Case Study:** Learning Game Design and Software Engineering through a Game Pro- totyping Experience

**Contents:** Generic process model: Process framework, umbrella activities, Process Adaptation, Per- spective Process Models - Waterfall Model, Prototyping, Incremental, and Agile Process Model: XP and Scrum, introduction to Principles of framework Activities, DevOps concepts and process

**Self Study:** Component based development process model.

**Further Readings:** Dynamic System Development Method.

| **UNIT 2** | **Requirement Analysis and Modelling** | **09 HOURS** |
|---|---|---|

**Applications/Case Study:** Online Marketing Software Platform

**Contents:** Requirement Engineering, Scenario based requirement modeling, Class based requirement modeling, Behavior based requirement modeling, Requirement modeling for web and mobile apps, Design Concepts, Design models, Architectural design, Static and Dynamic UML Diagrams: Class diagram, Object diagram, Use case, Activity diagram, Sequence diagram, Block diagram, Architectural diagram and Deployment diagram

**Self Study:**Interaction Model for Web and Mobile Apps

**Further Readings:**Configuration Models for Web Apps.

| **UNIT 3** | **Process Management and Estimation** | **08 HOURS** |
|---|---|---|

**Applications/Case Study:** Successful Application of Software Reliability by Norman F. Chnei- dewind

**Contents:** Software Configuration Management, Software Project Planning: Project Planning objec- tives, Software Metrics: Size, Function Point, Staffing, Project Estimation Methods Decomposition Techniques, Empirical Estimation Models COCOMO Model, Risk Management: Risk Identification, Analysis, mitigation methods

**Self Study:** Software Quality ISO Standards

**Further Readings:**ISO/IEC 9126 Software engineering

| **UNIT 4** | **Test Driven Development** | **08 HOURS** |
|---|---|---|

**Applications/Case Study:** Manual Testing (Online Marketing Software Platform)
**Contents:** System Testing - System Integration Techniques - Incremental, Top-Down Bottom, White box Testing, Black box Testing, Performance Testing, Security Testing, Acceptance testing
**Self Study:** Automated Testing life cycle
**Further Readings:**Software Reliability

| UNIT 5 | DevOps and Automation | 12 HOURS |
|---|---|---|

**Applications/Case Study:** Maven and Puppet
**Contents:**Introduction to DevOps life cycle, DevOps tools, Version Control System, GIT, Continuous Integration, Jenkin, Containerizing the applications, Docker life cycle, Docker commands, Kubernetes components, Kubernetes master slave architecture, Namespace, Application deployment in kubernetes cluster, Configuration management, Ansible architecture, Setting up master slave using ansible, Ansible playbook, Roles, Configurations using ansible, continuous monitoring, Nagios, Nagios Architecture, Nagios commands, Nagios plugins, Nagios notification
**Self Study:** GCP Cloud Computing and Storage in DevOps
**Further Readings:** Appdynamics

**TEXT BOOKS**


Roger Pressman(2023), *"Software Engineering: A Practitioner's Approach"*, McGraw-Hill Education; . 9th Edition, ISBN 13: 978-9355325044

Ian Somerville (2018), *"Software Engineering"* Pearson Publication; 9th edition, ISBN-13: 978-0- 13- 703515-1

Srinivasan Desikan (2007),*" Software Testing Principals and practices"*, Pearson Publication, ISBN-13 978- 8-17-758295-6


**REFERENCE BOOKS**


Kshirasagar Nak, Priyadarshi Tripathy(2008), *"Software Testing and Quality Assurance-Theory and Practice "*, John Wiley Sons Inc

Jeff Tian, John Wiley(2005) *"Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement "*, Jeff Tian, John Wiley Sons, Inc., Hoboken, New Jersey.


**E-RESOURCES**

1. https://nptel.ac.in/courses/106105182

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY<br>DEPARTMENT OF ARTIFICIAL INTELLIGENCE | COURSE NAME | SOFTWARE ENGINEERING LAB |
| | COURSE CODE | 2304313L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : 01/07/2025 | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :**

Prototyping

**COURSE OBJECTIVES :**

2304313L.CEO.1: To explore the software process model.

2304313L.CEO.2: To process requirement engineering and modeling for product development.

2304313L.CEO.3: To estimate and manage software metrics.

2304313L.CEO.4: To understand the test driven environment in software development. 2304313L.CEO.5: To illustrate DevOps lifecycle and different tools.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304313L.CO.1: Analyze conformance of the requirement and modeling related to project develop- ment.[L4]

2304313L.CO.2: Apply mitigation techniques for the risk associated with project development. [L3]

2304313L.CO.3: Demonstrate the usage of tools for project development phases. [L3]

**COURSE ABSTRACT:**

The Software Engineering course provide preparation for careers in system development, project management, and quality assurance with cutting-edge tools and methodologies. Enhance technical skills and problem-solving abilities essential for top tech roles.

| PRACTICALS | | |
|---|---|---|
| **PRACTICAL NO.01** | **4. Students are required to take a real-life scenario for software development (ERP, Mobile app, IoT project) and apply a correct Development paradigm for it with justification.**<br>**OR**<br>**Students can take mini or minor project/ DBMS project / DSF Project and explain which software development paradigm was used, what were the lim- itations of that paradigm. Students should propose a revised paradigm to overcome the limitations of ex- isting one with justification.**<br>**5. For the project, make a SRS in IEEE format.** | **6 HOURS** |
| Furthe practice NIL<br>r : | | |
| **PRACTICAL NO.02** | **Take your problem statement and design modelling using UML Diagrams.** | **4 HOURS** |
| Furthe practice NIL<br>r : | | |
| **PRACTICAL NO.03** | **Prepare a suitable cost estimation model, WBS, Gantt chart (using MS project tool) and all neces- sary estimation for your project.** | **4 HOURS** |
| Furthe practice NIL<br>r : | | |
| **PRACTICAL NO.04** | **Prepare the risk mitigation plan for the selected project.** | **4 HOURS** |
| Furthe practice NIL<br>r : | | |
| **PRACTICAL NO.05** | **Design test driven process for project based on asso- ciated risk and possible threats.** | **4 HOURS** |
| Furthe practice NIL<br>r : | | |
| **PRACTICAL NO.06** | **Use and demonstration of any two Devops tools for the project.** | **4 HOURS** |
| Furthe practice NIL<br>r : | | |
| **PRACTICAL NO.07** | **Final presentation: Report and PPT** | **4 HOURS** |
| Furthe practice NIL<br>r : | | |

**TEXT BOOKS**

Joakim Verona (2016), *Practical DevOps* , Packt Publishing Limited, 1$^{ed}$ Edition,O'Reilly Media Inc, ISBN-13 978-9352133765

Jennifer Davis Ryn Daniels, (2017) *Jenkins Essentials*. 2$^{ed}$ edition, Packt Publishing Limited, ISBN-13 978-1783553471

**REFERENCE BOOKS**

1. Mitesh Soni (2017). *Jenkins Essentials*. 2$^{ed}$ Edition , Packt Publishing Limited, ISBN-13 978-1783553471

**E-RESOURCES**

1. https://nptel.ac.in/courses/106105182

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Generative Artificial Intelligence |
| | COURSE CODE | 2304422T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE KNOWLEDGE :** Machine Learning, Deep Learning.

**COURSE OBJECTIVES :**

2304422T.CEO.1: Understand principles of generative models.

2304422T.CEO.2: Develop practical skills in building and deploying generative AI models. 2304422T.CEO.3: Analyze ethical considerations and impacts of generative AI in different fields. 2304422T.CEO.4: Explore advanced models such as GANs, VAEs, Diffusion Models, and Transformer-based architectures.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304422T.CO.1: Develop Generative AI models and diffusion models to generate data across various domains like images, text, and music [L3].

2304422T.CO.2: Use industry-standard tools and platforms for building, deploying, and scaling gener- ative AI models [L3].

2304422T.CO.3: Analyze the performance of Generative AI models for real world applications [L4].

2304422T.CO.4: Determine the ethical challenges posed by generative AI technologies, including bias, misinformation, and intellectual property concerns [L5].

**COURSE ABSTRACT:**

This advanced course in Generative AI explores the theoretical underpinnings and practical implemen- tations of AI models capable of generating original content. Leveraging foundational knowledge from Artificial Intelligence and Machine Learning and Deep Learning, students will delve into the architec- ture, training, and application of generative models, including Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Transformer-based models such as GPT.

Through hands-on projects and case studies, students will learn to design, implement, and evaluate generative models for tasks such as image synthesis, text generation, and style transfer. Emphasis is placed on understanding the ethical implications and potential biases of generative AI, as well as methods to mitigate risks in applications. By the end of the course, students will have practical expertise in deploying generative models and insights into emerging applications across industries.

**THEORY COURSE CONTENTS**

| UNIT 1 | Introduction to Generative AI | 08 HOURS |
|---|---|---|

**Applications/Case Study:** AI-Generated Music:Open AI's Jukebox, Text Generation:AI Dungeon **Contents:** Overview of AI and generative models. Difference between discriminative and generative models. Applications of generative models (art, music, image generation, etc.). Historical context of generative models. Large Language Models.

**Further Readings:** Interactive Generative Systems

| UNIT 2 | Autoencoders and Variational Autoencoders (VAE) | 09 HOURS |
|---|---|---|

**Applications/Case Study:** Medical Imaging, Anomaly Detection, Customer Segmentation and Recommendations

**Contents:** Introduction to Autoencoders (AE): Encoder, Decoder, Applications (Data Compression, Denoising). Variational Autoencoders (VAE): KL divergence, reparameterization trick, latent space exploration.

**Self Study:** Limitations of AEs and VAEs (overfitting, interpretability)

| UNIT 3 | Generative Adversarial Networks (GANs) | 08 HOURS |
|---|---|---|

**Applications/Case Study:** Synthetic Medical Imaging Data, Deepfake Creation and Detection. **Contents:** Introduction to GANs: Generator and Discriminator structure, Adversarial loss, Minimax optimization. Types of GANs: Vanilla GAN, Deep Convolutional GANs (DCGAN), Conditional GANs, Progressive Growing GAN. Challenges in GAN Training: Mode collapse, vanishing gradients.

**Further Readings:** Style Transfer and Creativity in Design: StyleGAN, CycleGAN

| UNIT 4 | Transformer-based Generative Models | 08 HOURS |
|---|---|---|

**Applications/Case Study:** OpenAI GPT-3, DALL-E and DALL-E 2, BERT.
**Contents:** Introduction to Transformers: Self-attention mechanism, Positional encoding. Transformer-based Generative Models: GPT (GPT-2, GPT-3), BERT for generative tasks. Text-to- Image Synthesis, Vision Transformers (ViT) and generative applications in image generation.

**Further Readings:** Creative Industries: Content Creation in Art, Music, and Design.

| UNIT 5 | Diffusion Models | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Medical Imaging Enhancement, Automotive Design and Simulation **Contents:** Introduction to Denoising Diffusion Probabilistic Models (DDPM). Producing high-quality, diverse outputs in image, video, and text generation
Iterative and probabilistic approach: Forward diffusion (adding noise) and reverse process (denoising)

**Self Study:** Multimodal Models

| UNIT 6 | Ethical, Societal, and Legal Dimensions of Generative AI | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Medical Imaging Enhancement, Automotive Design and Simulation **Contents: Ethics:** Fairness, transparency, accountability, bias mitigation, privacy, and human-AI collaboration in global and Indian contexts.
**Society:** Misinformation, job displacement, cultural diversity, trust restoration, and applications in education and healthcare worldwide and in India.
**Policy Law:** EU AI Act, General Data Protection Regulation, India's IT Act, Data Protection Bill, copyright, intellectual property, liability, and AI governance frameworks.
**Security Sustainability:** Deepfakes, misuse prevention, energy efficiency, carbon footprint, Paris Agreement, and National AI Strategy (NITI Aayog).

**TEXT BOOKS**


Jozefowicz, R., Zaremba, W., Sutskever, I. (2023). An Introduction to Generative Models with Applications. Cambridge University Press.

Choi, H., Kim, J. (2023). Generative AI: A Practical Guide to Applications and Ethics. Springer.

Liu, L., Xu, H. (2020). Generative deep learning: Teaching machines to paint, write, compose, and play. O'Reilly Media.

Goodfellow, I., Bengio, Y., Courville, A. (2016). Deep learning. MIT Press. https://www.deeplearningbook.org/

**REFERENCE BOOKS**

Ramesh, A., Pavlov, M., Goh, G., et al. (2022). DALL·E: Creating images from text. OpenAI. Retrieved from https://openai.com/research/dall-e

Lee, J., Kim, J. (2023). Generative AI for Software Engineering: Techniques and Tools. CRC Press.

**E-LEARNING RESOURCES**

Swayam Course on Generative AI and Large Language Models, By Naveen Kumar Bhansali, Indian Institute of Management Bangalore (IIMB).

OpenAI. (n.d.). Research and blog on AI advancements. Retrieved from https://www.openai.com/blog.

Coursera. (n.d.). Generative adversarial networks (GANs) specialization by DeepLearning.AI. Coursera. Retrieved from https://www.coursera.org

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Generative Artificial Intelligence LAB |
| | COURSE CODE | 2304422L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE KNOWLEDGE :** Machine Learning, Deep Learning.

**COURSE OBJECTIVES :**

2304422L.CEO.1: Develop practical skills in building and deploying generative AI models. 2304422L.CEO.2: Analyze ethical considerations and impacts of generative AI in different fields. 2304422L.CEO.3: Explore advanced models such as Generative Adversarial Networks , Variational Autoencoders, Diffusion Models, and

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304422L.CO.1: Analyze Generative AI models and diffusion models to generate data across various domains like images, text, and music [L4].

2304422L.CO.2: Evaluate the performance of Generative AI models for real world applications [L5].

2304422L.CO.3: Deploy generative AI for practical applications such as image synthesis, data augmentation, and creative content generation [L6].

**COURSE ABSTRACT:**

This advanced course in Generative AI explores the theoretical underpinnings and practical implemen- tations of AI models capable of generating original content. Leveraging foundational knowledge from Artificial Intelligence and Machine Learning and Deep Learning, students will delve into the architec- ture, training, and application of generative models, including Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Transformer-based models such as GPT.

Through hands-on projects and case studies, students will learn to design, implement, and evaluate generative models for tasks such as image synthesis, text generation, and style transfer. Emphasis is placed on understanding the ethical implications and potential biases of generative AI, as well as methods to mitigate risks in applications. By the end of the course, students will have practical expertise in deploying generative models and insights into emerging applications across industries.

| **PRACTICAL EXPERIMENTS** | | |
|---|---|---|
| **PRACT 1** | **Introduction to Generative AI** | **04 HOURS** |
| **Practical Experiment:**<br>c) Setting Up the Environment for Generative AI and Make use of generative models for creative content generation.<br>d) Implement simple probabilistic models like Gaussian Mixture Models. | | |
| **PRACT 2** | **Autoencoders and Variational Autoencoders (VAE)** | **04 HOURS** |
| **Practical Experiment**<br>8. Build a simple AE model for Dimensionality Reduction and Denoising.<br>9. Generate realistic faces or interpolate between facial features for creative applications in enter- tainment and design using VAE. | | |
| **PRACT 3** | **Generative Adversarial Networks (GANs)** | **04 HOURS** |
| **Practical Experiment:** Implement a DCGAN and/or cGAN on a chosen dataset to generate original image data, providing a comprehensive summary of the GAN architectures, training processes, and generated results. Conduct a comparative analysis of the models, evaluating their effectiveness in image quality and consistency. Conclude with a presentation that includes a case study analysis, discussing ethical considerations and challenges in real-world GAN applications. | | |
| **PRACT 4** | **Transformer-based Generative Models** | **04 HOURS** |

**Practical Experiment:**

3. Generate coherent and contextually relevant text using GPT models.
4. Create images based on text prompts using a text-to-image model to explore Transformer capa- bilities in multimodal tasks.

| PRACT 5 | Diffusion Models | 04 HOURS |
|---|---|---|

**Practical Experiment:** Implement a basic diffusion model for image generation by simulating the process of adding and removing noise. Use a pre-trained diffusion model to generate images from text prompts and compare results, highlighting model strengths, limitations, and ethical considerations.

| PRACT 6 | Generative AI in Action: The Capstone Experience | 10 HOURS |
|---|---|---|

This Lab Experiment serves as the culmination of the Generative AI course, where students apply their acquired knowledge and skills to develop a capstone project that demonstrates innovative use of generative models. Students will work in teams to ideate, design, and implement a project that addresses a real-world challenge or explores a creative application of generative AI. Learning Outcomes:

11. Formulate a project proposal based on identified needs or creative ideas in the field of Gen AI.
12. Collaborate effectively in teams to execute a Gen AI project.
13. Implement, Analyze and Evaluate a Gen AI model using appropriate methodologies and tools.
14. Communicate project outcomes through a detailed report/article and a professional presentation.

**TEXT BOOKS**

Jozefowicz, R., Zaremba, W., Sutskever, I. (2023). An Introduction to Generative Models with Applications. Cambridge University Press.

Choi, H., Kim, J. (2023). Generative AI: A Practical Guide to Applications and Ethics. Springer.

Liu, L., Xu, H. (2020). Generative deep learning: Teaching machines to paint, write, compose, and play. O'Reilly Media.

Goodfellow, I., Bengio, Y., Courville, A. (2016). Deep learning. MIT Press. https://www.deeplearningbook.org/

**REFERENCE BOOKS**

Ramesh, A., Pavlov, M., Goh, G., et al. (2022). DALL·E: Creating images from text. OpenAI. Retrieved from https://openai.com/research/dall-e

Lee, J., Kim, J. (2023). Generative AI for Software Engineering: Techniques and Tools. CRC Press.

**E-LEARNING RESOURCES**

Swayam Course on Generative AI and Large Language Models, By Naveen Kumar Bhansali, Indian Institute of Management Bangalore (IIMB).

OpenAI. (n.d.). Research and blog on AI advancements. Retrieved from https://www.openai.com/blog.

Coursera. (n.d.). Generative adversarial networks (GANs) specialization by DeepLearning.AI. Coursera. Retrieved from https://www.coursera.org

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| **DEPARTMENT OF E&TC ENGINEERING** | **W.E.F** | **AY:** 2026-2027 (Rev. 2023(NEP)) |
| **THIRD YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | Major Project - II |
| | **COURSE CODE** | 2304392L |
| | **COURSE CREDITS** | 2 |
| **RELEASE DATE : 01/07/2025** | **REVISION NO.** | |

| **TEACHING SCHEME** (HOURS/WEEK) | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**PREREQUISITE :** NIL

**COURSE OBJECTIVES :**

2304392.CEO.1: To equip students with the knowledge and skills necessary to design innovative engi- neering solutions for complex technical problems.

2304392.CEO.2: To train students in the practical implementation of engineering designs, ensuring they can bring theoretical concepts to life using modern tools and techniques.

2304392.CEO.3: To understand how to create detailed project plans that encompass all stages of im- plementation, from initial concept to final product.

2304392.CEO.4: To foster students ability to critically evaluate and iterate on their implementations, incorporating feedback and testing results to optimize performance and effectiveness.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304392.CO.1: Demonstrate proficiency in implementing engineering designs, utilizing modern tools, techniques, and technologies to bring their solutions to fruition [L4].

2304392.CO.2: Conduct rigorous testing and evaluation of implemented solutions, analyzing perfor- mance data to ensure that the solutions meet specified requirements and quality stan- dards [L5].

2304392.CO.3: Incorporate ethical considerations and sustainable practices into their implementation processes, evaluating the societal and environmental impacts of their solutions [L3].

**COURSE ABSTRACT:**

The project is most important part of undergraduate curriculum and enables students to develop analyti- cal, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Project Design, Project Implementation and Project Evaluation. After successful completion of project design phase in Sem V (project design), next step is project implementa- tion (Sem VI). The goal of this phase of the project is to implement/develop/experiment/simulate/test the techniques/processes of the project and give a mature shape. The implementation can be a combi- nation of algorithms, techniques, processes, testing etc. This will also include drawing inferences from the results and discussing them.

**GUIDELINES**

c) Preferably project group students of Sem V would be continued in this semester VI.

d) Every project group should consist of minimum 03 and maximum of 04 students.

e) The group members may be from different programs to support the interdisciplinary functioning.

f) Project group members and title of the project need to be approved by Project Guide and DEPARTMENT .

g) Projects should preferably have a national/international, industry/academic/research collabora- tion.

h) User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.

i) The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.

j) Define proposed solution and apply project management/modeling tools for project planning and design.

k) Define outcome, milestones, definite roadmap for project design, implementation, tools, resources, performance evaluation and documentation.

l) Perform refinement of System architecture & methodology.

m) Students should give a mature shape to their idea in terms of implementation. This is expected in this semester. This may include one or many of these points. Implementation /develop- ment/experimentation/simulation/testing/building the techniques/processes

**Collaborative/Sponsored Project**

Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for project work.

Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization at the start of semester VI.

Proposed Collaborative Project work need to be reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of 12 months.

Final assessment will be carried out in presence of faculty mentor, external mentor and examiner.

**TIMELINE**

c) Freezing of project groups and titles. Refinement of title and objectives from Sem V should freezed by the time of first review.

d) Final Synopsis of the project. (To be done at guide level)

e) Methodology / System Design / Block Diagram should be properly explained by the student

f) Project Review I Presentation.

g) Project Implementation: Students should take the work in one and/more of the points. Like Implementation/development/experimentation/simulation/testing/experimental yield/building the techniques/processes etc. . .

h) Based on the points discussed in 5, student would be able to get results and discuss them. Students should be able to draw inferences from results.

i) Project Review II Presentation.

j) Quality of Publication and Researchers: Students would be educated on different technical papers and their importance (article types, journal metrics etc) along with author/researcher credentials.

k) Project Documentation: Project Report Writing

## ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

c) Project Review I: Problem Statement and objectives, Implementation plan & action (algo- rithms/techniques/models/mathematical understanding/implementation) (10 Marks)

d) An activity on illustrating methodology. This may inlcude paper reading activity: Read and Summarize a paper in 1 page (Individual to every student of the group). Any other activity can also be taken take would illustrate methodology (10 marks)

e) Project Review II: Results and Implementation, Observations, Inferences, Discussion on algo- rithms / techniques /models / testing) (10 Marks)

f) Article Quality and Author Credentials: Information about Research Article types, paper quality metrics (SCI/SCOPUS/WOS) and Author Credentials (Citation count, h-index, I10 index etc) (5 marks)

g) Project Report (10 Marks)

h) Project: Documentation Final Presentation and Demonstration (30 Marks)

~~(Parameters of evaluation: Final implemented work, report, presentation and paper~~ drafted based on work)

## TEXT BOOKS

John M. Nicholas. (2012). *Project Management for Engineering, Business and Technology*. 4th Edition, Butterworth-Heinemann. ISBN 978-0080967042.

Leslie Lamport. (1994). LaTeX: *A document preparation system, User's guide and reference manual*. 2nd Edition, Addison-Wesley. ISBN 978-0201529838.

## REFERENCE BOOKS

Michelle Reid. (2018). *Report Writing (Pocket Study Skills)*. 2nd Edition, Bloomsbury Publishing. ISBN 978-0230376557.

Sara Efrat Efron and Ruth David. (2018). *Writing the Literature Review : A Practical Guide*. 1st Edition, Guilford Press . ISBN 978-1462536894 .

## E-RESOURCES

e-Yantra: Engineering for better Tomorrow

Zotero

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

**MIT ACADEMY OF ENGINEERING, ALANDI**

**Curriculum for**

**Final Year**

**Bachelor of Technology**

**Artificial Intelligence**

**NEP**

(With Effect from Academic Year:)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE STRUCTURE (NEP ) | | |
|---|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W. E. F. | : | |
| FINAL YEAR BACHELOR OF TECHNOLOGY | RELEASE DATE | : | |
| | REVISION NO. | : | NEP |

| SEMESTER: VII Artificial Intelligence (PART A) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | | CREDIT |
| | | | Hour/Week | | | THEORY | | | PRACT | | TOTAL | | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | | |
| PCC | 2311411T | System Design | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 | |
| PEC | 2311421T | Big Data Analytics | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 | |
| | 2311422T | Business Intelligence | | | | | | | | | | | |
| | 2311423T | MLOPs for AI Practitioner | | | | | | | | | | | |
| | 2311421L | Big Data Analytics Lab | - | 2 | - | - | - | - | 20 | 30 | 50 | 1 | |
| | 2311422L | Business Intelligence Lab | | | | | | | | | | | |
| | 2311423L | MLOPs for AI Practitioner Lab | | | | | | | | | | | |
| MDM | *MDM List | MDM Course-IV | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 | |
| HSSM MEC | 2311476T | Project Management | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 | |
| ELC PRJ | 2311491L | Major Project - III | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 | |
| ELC PRJ | 2311492T | Research Methodology | 2 | - | - | 35 | - | 40 | - | - | 75 | 2 | |
| ELC SI | 2311496L | Summer Internship (Technical) | - | - | - | - | - | - | - | 150 | 150 | 4 | |
| TOTAL | | | 13 | 6 | - | | | | | | 750 | 20 | |

| SEMESTER: VIII Artificial Intelligence(PART A) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COURSE | | | TEACHING SCHEME | | | EXAMINATION SCHEME AND MARKS | | | | | | CREDIT |
| | | | Hour/Week | | | THEORY | | | PRACT | | TOTAL | |
| TYPE | CODE | NAME | TH | P | TU | IA | MSE | ESE | CA | D/P | | |
| PCC | 2311412T | Cyber Security | 4 | - | - | 60 | - | 90 | - | - | 150 | 4 |
| PEC | 231142XT | Program Elective Course | 3 | - | - | 40 | - | 60 | - | - | 100 | 3 |
| | 2311SWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| MDM | *MDM List | MDM Course-V | 3 | - | - | 40 | | 60 | - | - | 100 | 3 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2311SWXX | Swayam Course* | - | - | - | 25 | | 75 | - | - | | |
| OE | 230145XX | Professional Certification Course* | - | 4 | - | - | - | - | 35 | 40 | 75 | 2 |
| ELC SI | 23XX497L | Semester-Long Internship | - | - | - | - | - | - | 150 | 150 | 300 | 8 |
| | 23XX498L | Semester Exchange | - | - | - | - | - | - | | | | |
| | 23XX493L | Capstone Portfolio | - | - | - | - | - | - | | | | |
| **TOTAL** | | | **10** | **4** | **-** | | | | | | **725** | **20** |

*Credits earned in advance through a credit transfer scheme

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**COURSE SYLLABUS**

| | | |
|---|---|---|
| **DEPARTMENT OF ARTIFICIAL INTELLIGENCE** | **W.E.F** | **AY:** |
| **FINAL YEAR BACHELOR OF TECHNOLOGY** | **COURSE NAME** | SYSTEM DESIGN |
| | **COURSE CODE** | 2304411T |
| | **COURSE CREDITS** | 4 |
| **RELEASE DATE : 01/07/2026** | **REVISION NO.** | |

**TEACHING SCHEME (HOURS/WEEK)**

| | | **EXAMINATION SCHEME AND MARKS** | | | | | |
|---|---|---|---|---|---|---|---|
| | | **THEORY** | | | **LABORATORY** | | |
| **LECTURE** | **PRACTICAL** | **IA** | **MSE** | **ESE** | **CA** | **PRACT/DEMO/PRES.** | **TOTAL** |
| 4 | NIL | 60 | NIL | 90 | NIL | NIL | 150 |

**PREREQUISITE : Software Engineering**

**COURSE OBJECTIVES :**

2304411T.CEO.1: 1.To Introduce the fundamental principles of system design, architectural styles, and system types used in modeling real-world applications. .

2304411T.CEO.2: To impart an understanding of human-computer interaction and usability principles to ensure system designs meet user needs effectively.

2304411T.CEO.3: To familiarize with the design process and

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304411T.CO.1: Analyze system design principles to model real-world applications using appropriate architectural styles, system types, and modeling tools.[L4]

2304411T.CO.2: Apply human-computer interaction principles and usability heuristics for effective and user-friendly interfaces for responsive systems.[L3]

2304411T.CO.3: Identify interactive system components using

**COURSE ABSTRACT:**

System Design introduces students to the principles and practices involved in designing scalable, reliable, and user-centered software systems. It covers the end-to-end design process from high-level architecture to low-level component design while integrating essential concepts from Human-Computer Interaction and UI/UX design.The course prepares students to design modern software systems that are not only efficient and robust, but also accessible and user-friendly.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION TO SYSTEM DESIGN & MODELING CENTERED NEEDS** | **10 HOURS** |

**Applications/Case Study:** Online Course Management System,Ride-Sharing App (like Uber),Smart Home Automation System.

**Contents:** Definition and characteristics of system design, Types of systems: Monolithic, Dis- tributed, Microservices, Design considerations: Scalability, reliability, availability, fault tolerance, maintainability, Architectural styles: Layered, Client-server, Microservices, Event-driven, Communi- cation protocols: REST vs WebSockets ,Requirement gathering and UML Modeling.

**Self Study:** Event-Driven Architecture-Role of asynchronous communication,Event sourcing vs. traditional CRUD models.

**Further readings:** Domain-Driven Design (DDD) – Strategic Concepts, Ubiquitous language,
Bounded contexts.

| | | |
|---|---|---|
| **UNIT 2** | **USABILITY DESIGN** | **10 HOURS** |

**Applications/Case Study:** Online Food Delivery Platform, E-commerce Website,Messaging App(WhatsApp).

**Contents:**Human-Computer Interaction:Importance,Role, Human Factors in system design :Cognitive and Physical, Ergonomics, Usability, User Interface (UI) principles , Bridging Requirements with UX design:User-centered insights, High Level Design: Performance and Maintainability, Interaction Models in Architecture: Norman's Action Cycle & Gulf of Execution/Evaluation, Aligning system flow with user tasks and feedback loops,Shneiderman's Eight Golden Rules for Interface Design,UI behavior under different architectural choices (real-time vs batch).

**Self Study:** Psychology and the design of Interactive Systems.
**Further Readings:**Agent based Interfaces.

| UNIT 3 | DESIGN PROCESS AND INTERACTION STYLES | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Travel Booking System(MakeMyTrip),Inventory Management UI, Dash- board for IoT Data.

**Contents:** Four Pillars of Design, Process of Design, Ethnographic Observations, ContextualInquiry, Iterative Design, Participatory Design, Navigation Design, Visual Design: Layout, Color,Fonts, Label- ing,Scenarios,Interaction Styles:Direct Manipulation, Menu Selection, Form-Filling, Commands, Nat- ural Language, Internationalization, Interaction Design Patterns,HCI in software process: interactive systems and SDLC.

**Self Study:** GOMS(Goals, Operators, Methods, and Selection rules) Keystroke-Level Model:Efficiency in interface actions.

**Further Readings:** Responsive and Adaptive UI Design, UI structure adaptation across de- vices(desktop, mobile, kiosk).

| UNIT 4 | PERFORMANCE, SCALABILITY AND USABILITY EVALU- ATION | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Case Study on Live Quiz App,Election Result Dashboard.

**Contents:** System Performance, Scalability-Horizontal vs vertical scaling,load balancing, Content Delivery Network and edge computing for faster content delivery, Caching strategies for UI respon- siveness (front-end and back-end), Performance bottlenecks: detection and profiling, Evaluation: Heuristic Evaluation, Cognitive Walkthrough, Expert Reviews, User Surveys, Think Aloud, A/B testing, heatmaps, analytics.

**Self Study:** Case Studies of High-performance systems with good/bad UX.

**Further readings:** Information Architecture.

| UNIT 5 | Security, Accessibility, and Ethical Design in Systems | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Healthcare Portal (HIPAA-compliant system)-Secure UI and audit log- ging,Social Media Platform-Analysis of ethical concerns (privacy, addiction, content surfacing), Gov- ernment Service Portal- Accessibility audit and improvement plan

**Contents:** Authentication and Authorization (OAuth2, JWT), Secure UI design (password inputs, feedback handling), Data privacy principles (PII, GDPR, HIPAA), Accessibility in System Design: Importance of inclusive design, WCAG principles (Perceivable, Operable, Understandable, Robust), Designing for diverse user needs (visual, motor, cognitive impairments), Ethics and Responsible De- sign: Dark patterns vs user-centered design, Designing for transparency and informed consent, Data ethics: What not to collect, when not to personalize etc.

**Self Study:** Common Web Security Vulnerabilities.

**Further Readings:** AI and Ethics in Personalization.

| UNIT 6 | PROTOTYPE DESIGN | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Low Level Design for a Ride-Sharing App Uber/Ola, Chat Application.

**Contents:** Common design patterns (Factory, Singleton, Observer), Connecting UI flows to system functions (LLD-to-UI mapping) , frontend–backend integration principles, state management in UI applications including Redux and Context API, SOLID principles in UI and backend service design.

**Self Study:** Job Scheduling System (e.g., Cron, Airflow): Design classes and interactions.
**Further Readings:** Patterns for Effective Interaction Design.

**TEXT BOOKS**


Alen Dix,Janet Finlay,Human Computer Interaction,4th Edition,Pearson Publication,ISBN 0130461091

Grady Booch, James Rumbaugh, and Ivar Jacobson,The Unified Modeling Language User Guide,Addison Wesley,ISBN 978-0134852157

Martin Kleppmann, Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scal- able, and Maintainable Systems,O'Reilly

Richard N. Taylor, Nenad Medvidovic, Eric Dashofy Software Architecture: Foundations, Theory, and Practice,Wiley,978-0470167748

Alex Xu,System Design Interview:An Insider's Guide (Vol 1&2),Publisher:Shroff/bytebytego,979- 8664653403


**REFERENCE BOOKS**


Kent Norman, JurekKirakowski, Handbook of Human Computer Interaction" Wiley Publica- tion,ISBN 9781118976135

Martin L. Abbott ,Michael T. Fisher, The Art of Scalability-Scalable Web Architecture, Pro- cesses,and Organizations for the Modern Enterprise,Addison Wesely 978-0-13-403280-1.

Sam Newman, Building microservices.O'Reilly, ISBN 9789391043384

Nick Rozanski E´oin Woods,Software Systems Architecture,ISBN - 978-8131726136

Allen I. Hollub, Compiler Design in C, PHI, 2015. ISBN: 978-93-325-4950-0

Helen Sharp, Jenifer Preece Interaction Design beyond Human Computer Interaction" 5th Edi- tion, ISBN 978-1119547259

Donald Norman, The Design of Everyday Things", 2002 Edition, Basic Books, ISBN 100- 465067107


**E-RESOURCES**

Microservices *blog.dreamfactory.com/ microservices-examples*

*https://arxiv.org/abs/2006.04975*

3. Models and Techniques for Ensuring Safety Availability, and Reliability.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Big Data Analytics |
| | COURSE CODE | 2304421T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

**PREREQUISITE :** Requires knowledge of Descriptive Analytics, Predictive Analytics

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304421T.CO.1: Demonstrate Big Data technologies and Hadoop ecosystem components [L3].

2304421T.CO.2: Apply big data concepts, architectures, and frameworks to solve large-scale data problems. [L3].

2304421T.CO.3: Apply big data technologies, including Pig, Hive, and Apache Spark, to analyze large- scale datasets.[L3].

2304421T.CO.4: Analyze real-world case studies and select appropriate big data tools and frameworks for their resolution.[L4].

**COURSE ABSTRACT:**

This course on Big Data Analytics provides a comprehensive overview of the principles, technologies, and tools used to manage, analyze, and visualize large datasets. Students will explore the characteristics of big data, including its volume, velocity, variety, veracity, and value. Through hands-on projects and real-world case studies, participants will gain experience using popular big data technologies such as Hadoop, Hive, Apache Spark, and NoSQL databases like Habse. By the end of the course, students will be equipped with the skills and knowledge necessary to apply big data analytics in various industries, enabling them to make data-driven decisions

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **Introduction To Big Data And Hadoop** | **08 HOURS** |

**Applications/Case Study:** Healthcare Monitoring and cause Detection

**Contents:** Introduction to Big Data, Sources of Big Data, 5 V's of Big Data, Big Data Analytics, Challenges of Traditional System, Challenges of Big data, Distributed Systems, Introduction to Apache Hadoop, Hadoop Features, Components of Hadoop Ecosystem, Hadoop Architecture, Com- mercial Hadoop Distributions.

**Self Study:** Environmental Setup and Custer management of Hadoop

**Further Readings:** Hadoop Security Architecture .

| | | |
|---|---|---|
| **UNIT 2** | **HDFS (Hadoop Distributed File System)** | **06 HOURS** |

**Applications/Case Study:** Retail Analytics with HDFS.

**Contents:** Introduction to HDFS, Features and Goals, Internal Architecture and HDFS Workflow, HDFS Concepts, Command Line Interface (CLI), Hadoop file system interfaces, HDFS File Operations, YARN Components, Benefits of YARN,Data flow, Data Ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: Compression, Serialization - Avro, parquet, File-Based Data structures.

**Self Study:** Performance Evaluation in HDFS.

**Further Readings:** HDFS architecture in cloud computing.

| | | |
|---|---|---|
| **UNIT 3** | **Map Reduce Framework** | **06 HOURS** |

**Applications/Case Study:** Search: Web Indexing.

**Contents:** Introduction to MapReduce, Framework, Compilation and Execution Process Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map-Reduce Types and Formats, Map Reduce Features. MapReduce Use Cases. Input Splits, Relation between Input Splits and HDFS Blocks Combiner Practitioner.

**Self Study:** Map Reduce versus Spark.

**Further Readings:** Map reduce in Cloud Computing.

| UNIT 4 | Apache Pig and Hive | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Sentiment Analysis on social media.

**Contents: Apache Pig -** Introduction to PIG, Execution Modes of Pig, Pig-Latin Grunt, Pig data types, Load and Store operations. The Pig operators- Diagnostics Operators, Data Processing oper- ators, Relational Operators, Group Operator, Joins, Union in Pig, Built In Functions (Eval, Math, String, Date).

**Apache Hive -** Introduction to Hive, Hive Shell, Hive Services, Hive Metastore, Hive DDL and DML, Hive Databases, creating new table, Basics and Internal Table, external table, Loading Different File Formats, Load Data Into Hive Table, Hive Indexes and View, Hive Partitions Buckets, Hive Function Built-in User Defined Functions.

HiveQL: Simple Operations On Hive Table, query operations on hive table, Querying Complex Struc- tures From A Table, Join Sub-Query.

**Self Study:** Difference between Pig and Hive. Technology Comparison with Traditional Databases.

**Further Readings:** Hive ETL

| UNIT 5 | Hadoop Databses - Apache HBase, Cassandra, CouchDB | 06 HOURS |
|---|---|---|

**Applications/Case Study:** Financial Services Analytics with HBase.

**Contents:** Apache HBase: Introduction, Concepts, HBase Vs RDBMS, HBase prerequisites, Base Architecture, Components, and Data Model, HBase Shell Commands, HBase Table operations, Create, Insert Retrieve Data in HBase, Using Apache HBase Shell, Conceptual Physical View, Name-space, Tables, Rows, Cells Column Family, Sort Order, Column Metadata, joins, ACID, Schema Design,Row Key design,Constraints,Catalog Tables, Storing Medium-sized Objects, Backup and Restore commands. Introduction to Cassandra, CouchDB.

**Self Study:** NoSQL Databases

**Further Readings:** NoSQL Databases integration in cloud technology.

| UNIT 6 | Apache Spark | 09 HOURS |
|---|---|---|

**Applications/Case Study:** Recommender systems.

**Contents:** Introduction, Spark Architecture, Spark Cluster Architecture, Spark Master and Worker node Service, Spark DAG, Spark Executor Spark core programming concepts, compilation and execu- tion of spark program. Resilient distributed databases (RDD),

Introduction to Spark Data Frames, Data Frames Overview, Spark Data Frame Operations, Group By and Aggregate Functions, Missing data, Date and Timestamps.

**Self Study:** Hadoop MapReduce Vs Apache Spark.

**Further Readings:** Mobile big data analysis using Apache Spark.

**TEXT BOOKS**

DT Editorial Services. (2016). *Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization*. 1st Edition, Dreamtech Press. ISBN: 978-8184891430.

Tom White.(2016). *Hadoop: The Definitive Guide*. 4th Edition, O'Reilly. ISBN: 978-9352130672.

4. Bill Chambers.(2018). *Spark: The Definitive Guide - Big Data Processing Made Simple* 1st .

**REFERENCE BOOKS**

Dipak Vohra (2016). *Practical Hadoop Ecosystem:A Definitive Guide to Hadoop Frameworks and Tool*. 1st Edition, A-Press, ISBN: 978-1484221983.

Arshdeep Bahga, Vijay Madisetti. (2016). *Big Data Science Analytics: A Hands-On Approach*. 1st Edition, VPT, ISBN: 978-0996025546.

Vaddeman, Balaswamy. (2018). *Beginning Apache Pig*. 1st Berkeley, CA: Apress. ISBN: 978- 1484223369.

Holden Karau, Rachel Warren. (2017). *Beginning Apache Pig*. 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9352135615.

Mamta Mittal , Valentina E. Balas , Lalit Mohan Goyal, Raghvendra Kumar. (2018).

**E-RESOURCES**

https://hadoop.apache.org/docs/stable/
https://nptel.ac.in/courses/106104189

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Big Data Analytics Lab |
| | COURSE CODE | 2304421L |
| | COURSE CREDITS | 1 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| NIL | 2 | NIL | NIL | NIL | 20 | 30 | 50 |

**PREREQUISITE :** Requires knowledge of Descriptive Analytics, Predictive Analytics

**COURSE OBJECTIVES :**

2304421L.CEO.1: To explore the significance of big data technologies in data-driven world.
2304421L.CEO.2: To demonstrate usage of Bigdata frameworks Map reduce, Apache Spark to perform analytics over large datasets.
2304421L.CEO.3: To illustrate usage of analytical tools and

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304421L.CO.1: Apply big data tools and frameworks (e.g., Hadoop, Map Reduce, Spark) to process large datasets. [L3].
2304421L.CO.2: Analyze large datasets using technologies pig, hive, Apache spark, etc.[L4].
2304421L.CO.3: Evaluate real-world case studies using big data implementations. [L5].
2304421L.CO.4: Develop visualization and dashboards to interpret and communicate analytical results effectively [L3].

**COURSE ABSTRACT:**

This course on Big Data Analytics provides a comprehensive overview of the principles, technologies, and tools used to manage, analyze, and visualize large datasets. Students will explore the characteristics of big data, including its volume, velocity, variety, veracity, and value. Through hands-on projects and real-world case studies, participants will gain experience using popular big data technologies such as Hadoop, Hive, Apache Spark, and NoSQL databases like Habse. By the end of the course, students will be equipped with the skills and knowledge necessary to apply big data analytics in various industries, enabling them to make data-driven decisions.

| **PRACTICALS** | | |
|---|---|---|
| **PRACTICAL NO.01** | **Hadoop Installation and Commands** | **4 HOURS** |
| A. Installation of the Hadoop under windows 10/ Linux (Min. 2 GBRAM)/ Virtual Machines or Hadoop Distribution of Cloudera (Min Requirement 8 GB RAM)<br>B. Execution of basic Hadoop Commands | | |
| **PRACTICAL NO.02** | **Map Reduce Framework** | **4 HOURS** |
| Implementation of Word Count program using Map Reduce Framework. | | |
| **PRACTICAL NO.03** | **Apache Pig** | **4 HOURS** |
| Apache PIG exercises using Given dataset Create two file as fil11.txt and file2.txt, Insert students details (least 10 records) like (rollno, name, age, city, etc) but not limited to, and perform following operations 1. Load the files using PigStorage<br>2. Perform task using Diagnostic Operator - Dump operator,Describe operator,Explain operator, Il- lustration operator<br>3. Grouping and Joining - Group Operator, Cogroup Operator, Join Operator,Cross Operator<br>4. Combining Splitting - Union Operator, Split Operator<br>5. Filtering - Filter Operator, Distinct Operator, Foreach Operator<br>6. Sorting - Order By, Limit Operator<br>7. Built-in Functions | | |
| **PRACTICAL NO.04** | **Apache Hive** | **4 HOURS** |
| Apache Hive: DDL, DML Statement using Apache Hive Execution of Given Queries on various dataset. | | |
| **PRACTICAL NO.05** | **Apache HBase** | **4 HOURS** |
| Apache HBase: DDL, DML Operations, HBase Operations- read and Write using Metatable. | | |
| **PRACTICAL NO.06** | **Apache Spark** | **4 HOURS** |
| Social Media (Facebook/witter) Analysis using Spark. | | |
| **MINI PROJECTS** | **For Practical Exam** | **6 HOURS** |
| Students need to complete mini project which will be evaluated under Practical Exam. | | |

**TEXT BOOKS**

DT Editorial Services. (2016). *Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization*. 1st Edition, Dreamtech Press. ISBN: 978-8184891430.

Tom White.(2016). *Hadoop: The Definitive Guide*. 4th Edition, O'Reilly. ISBN: 978-9352130672.

4. Bill Chambers.(2018). *Spark: The Definitive Guide - Big Data Processing Made Simple* 1st .

**REFERENCE BOOKS**

Dipak Vohra (2016). *Practical Hadoop Ecosystem:A Definitive Guide to Hadoop Frameworks and Tool*. 1st Edition, A-Press, ISBN: 978-1484221983.

Arshdeep Bahga, Vijay Madisetti. (2016). *Big Data Science Analytics: A Hands-On Approach*. 1st Edition, VPT, ISBN: 978-0996025546.

Vaddeman, Balaswamy. (2018). *Beginning Apache Pig*. 1st Berkeley, CA: Apress. ISBN: 978- 1484223369.

Holden Karau, Rachel Warren. (2017). *Beginning Apache Pig*. 1st Greyscale Indian Edition, O'Reilly. ISBN: 978-9352135615.

Mamta Mittal , Valentina E. Balas , Lalit Mohan Goyal, Raghvendra Kumar. (2018).

**E-RESOURCES**

https://hadoop.apache.org/docs/stable/
https://nptel.ac.in/courses/106104189

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department Of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Business Intelligence |
| | COURSE CODE | 2311422T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

Pre-Requisite:

Basic knowledge of databases
Fundamentals of management information systems
Introductory concepts of data and information systems

Course Objectives:

2311422T.CO1: Understand the fundamentals and evolution of Business Intelligence.
2311422T.CO2: Analyze BI architectures, platforms, and value chains.
2311422T.CO3: Explain data warehousing and OLAP concepts.
2311422T.CO4: Examine BI tools and analytical techniques.
2311422T.CO5: Understand BI user models, dashboards, and KPIs.
2311422T.CO6: Evaluate emerging trends and challenges in Business Intelligence.

Course Outcomes:

2311422T.CO1: Understand the basic concepts, components, and applications of Business Intelligence.
2311422T.CO2: Explain the role of BI in organizational value chain analysis.
2311422T.CO3: Examine BI models and their contribution to business success.
2311422T.CO4: Analyze data warehousing and OLAP techniques for business analysis.
2311422T.CO5: Interpret BI reports, dashboards, and KPIs for decision-making.
2311422T.CO6: Identify emerging BI technologies and future trends.

Course Abstract:

This course provides a comprehensive understanding of Business Intelligence (BI) concepts, architectures, tools, and techniques used to transform raw data into meaningful information for strategic decision-making. It covers BI foundations, data warehousing, OLAP, dimensional modeling, analytics, reporting, dashboards, KPIs, and emerging BI trends. Students will gain theoretical knowledge of BI systems and their role in organizational success.

**THEORY COURSE CONTENTS**

| | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION TO BUSINESS INTELLIGENCE** | **08 HOURS** |

**Applications/Case Study:** Decision support in Retail and Banking Industry
**Contents:** : Introduction to Business Intelligence – Definition and Meaning – History and Evolution of Business Intelligence – Difference between Data, Information and Intelligence – Business Intelligence Segments – Business Intelligence Value Chain – Factors of Business Intelligence System – Role of BI in Decision Making – Real Time Business Intelligence – Business Intelligence Applications.
**Self-Study:** Business Intelligence in E-Commerce
**Further Readings:** Business Intelligence in Healthcare and Education

| | | |
|---|---|---|
| **UNIT 2** | **ESSENTIALS OF BUSINESS INTELLIGENCE** | **07 HOURS** |

**Contents:** Business Intelligence Environment – Business Intelligence Landscape – Types of Business Intelligence – Business Intelligence Platforms – Business Intelligence Architecture – Dynamic Roles in Business Intelligence – Information Workers – Challenges in Business Intelligence – Business Intelligence Tools – Modern and Enterprise Business Intelligence.
**Self Study:** Self-Service Business Intelligence
**Further Readings:** Cloud Based Business Intelligence Platforms

| | | |
|---|---|---|
| **UNIT 3** | **DATA WAREHOUSING AND MULTIDIMENSIONAL ANALYSIS** | **08 HOURS** |

**Applications/Case Study:** Sales Analysis using Data Warehouse
**Contents:** Introduction to Data Warehouse – Characteristics of Data Warehouse – Dimensional Data Warehouse – Fact Table and Dimension Tables – Measures and Attributes – Hierarchies and Dimensions – Surrogate Keys – Star Schema and Snowflake Schema – Alternative Table Structures – Multidimensional Data Models.
**Self-Study:** Fact Constellation Schema.
**Further Readings:** Slowly Changing Dimensions

| | | |
|---|---|---|
| **UNIT 4** | **ONLINE ANALYTICAL PROCESSING (OLAP)** | **08 HOURS** |

**Applications/Case Study:** Financial and Marketing Analysis using OLAP
**Contents:**
Introduction to OLAP – Need for OLAP – Types of OLAP (ROLAP, MOLAP, HOLAP) – OLAP Architecture – Multidimensional OLAP Cubes – OLAP Operations: Roll-up, Drill-down, Slice and Dice – Fast Response and Metadata-Based Queries – Advantages and Limitations of OLAP – OLAP Applications.
**Self-Study:** Spreadsheet based OLAP Analysis
**Further Readings:** Comparison of OLTP and OLAP

| UNIT 5 | BUSINESS INTELLIGENCE ANALYTICS AND PERFORMANCE MANAGEMENT | 08 HOURS |
|---|---|---|

**Applications / Case Study:** Performance Measurement in Manufacturing Industry

**Contents:**

Measures and Metrics – Aggregate Functions – Calculated Measures – Business Analytics Overview – Descriptive and Predictive Analytics – Dashboards – Key Performance Indicators (KPIs) – BI Reporting – Visualization Techniques – Performance Management using BI.

**Self-Study:** Balanced Scorecard

**Further Readings:** Visual Analytics for Business Intelligence

| UNIT 6 | DATA MINING, REPORTING AND EMERGING BI TRENDS | 06 HOURS |
|---|---|---|

**Applications / Case Study:** Customer Behavior Analysis

**Contents:**

Introduction to Data Mining – Meaning and Purpose of Data Mining – Data Mining Process – Data Mining Models – Classification, Clustering and Association – Business Intelligence Reporting Tools – BI Reports – Emerging Trends in Business Intelligence – Big Data Analytics – Cloud BI – Ethical Issues and Challenges in Business Intelligence – Future of Business Intelligence.

**Self-Study:** Predictive Analytics in Business

**Further Readings:** AI and Machine Learning in Business Intelligence

**Text Books:**


1. Turban, E., Sharda, R., Delen, D, *Business Intelligence and Analytics: Systems for Decision Support*, Pearson
2. Cindi Howson, *Successful Business Intelligence*, McGraw-Hill
3. Ralph Kimball & Margy Ross, *The Data Warehouse Toolkit*, Wiley.


**REFERENCE BOOKS:**


1. Larissa Moss & Shaku Atre. Business Intelligence Roadmap, Addison-Wisley
2. Alex Berson & Stephen J. Smith, Data Warehousing, Data Mining and OlAP, McGraw-Hill
3. David Loshin. Business Intelligence, The Savvy Managers Guide, Morgan Kaufmann.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department Of ARTIFICIAL INTELLIGENCE | W.E.F | AY: 2 |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Business Intelligence Lab |
| | COURSE CODE | 2311422L |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

Pre-Requisite:

Basic knowledge of databases
Fundamentals of management information systems
Introductory concepts of data and information systems

Course Objectives:

2311422L.CO1: Understand the fundamentals and evolution of Business Intelligence.
2311422L.CO2: Analyze BI architectures, platforms, and value chains.
2311422L.CO3: Explain data warehousing and OLAP concepts.
2311422L.CO4: Examine BI tools and analytical techniques.
2311422L.CO5: Understand BI user models, dashboards, and KPIs.
2311422L.CO6: Evaluate emerging trends and challenges in Business Intelligence.

Course Outcomes:

2311422L.CO1: Understand the basic concepts, components, and applications of Business Intelligence.
2311422L.CO2: Explain the role of BI in organizational value chain analysis.
2311422L.CO3: Examine BI models and their contribution to business success.
2311422L.CO4: Analyze data warehousing and OLAP techniques for business analysis.
2311422L.CO5: Interpret BI reports, dashboards, and KPIs for decision-making.
2311422L.CO6: Identify emerging BI technologies and future trends.

Course Abstract:

This course provides a comprehensive understanding of Business Intelligence (BI) concepts, architectures, tools, and techniques used to transform raw data into meaningful information for strategic decision-making. It covers BI foundations, data warehousing, OLAP, dimensional modeling, analytics, reporting, dashboards, KPIs, and emerging BI trends. Students will gain theoretical knowledge of BI systems and their role in organizational success.

**PRACTICAL: Perform following experiments**

| **PRACTICAL NO.01** | | **08 HOURS** |
|---|---|---|

**Practice Lab Assignment**

- Study the components of a Business Intelligence system.
- Identify data sources used in Business Intelligence applications.
- Differentiate between Data, Information, and Intelligence using real-world examples.

**Lab Assignment**

- Analyze a business scenario and identify how Business Intelligence supports decision-making.
- Prepare a flow diagram representing the Business Intelligence value chain.

**Self Study Assignment**

1. Study real-time Business Intelligence and list its advantages.
2. Identify at least three applications of Business Intelligence in different industries.

| **PRACTICAL NO.02** | | **07 HOURS** |
|---|---|---|

**Practice Lab Assignment**

- Study different types of Business Intelligence platforms.
- Identify various roles of users in a Business Intelligence environment.

**Lab Assignment**

- Compare Traditional Business Intelligence and Modern Business Intelligence platforms.
- Identify challenges faced while implementing Business Intelligence systems in organizations.

**Self Study Assignment**

1. Study Enterprise Business Intelligence and Self-Service Business Intelligence.
2. List popular Business Intelligence tools and their applications.

| **PRACTICAL NO.03** | | **08 HOURS** |
|---|---|---|

**Practice Lab Assignment**

- Study the structure of a Data Warehouse.
- Identify facts, dimensions, attributes, and hierarchies from a given business dataset.

**Lab Assignment**

- Design a dimensional data warehouse model for a sales management system.
- Identify fact tables, dimension tables, and surrogate keys.

**Self Study Assignment**

1. Compare Star Schema and Snowflake Schema.
2. Study Slowly Changing Dimensions and their types.

| **PRACTICAL NO.04** | | **08 HOURS** |
|---|---|---|

**Practice Lab Assignment**

- Study OLAP architecture and types of OLAP.
- Identify different OLAP operations used for data analysis.

**Lab Assignment**

- Perform OLAP operations (Roll-up, Drill-down, Slice, Dice) on a multidimensional dataset.
- Analyze business trends using OLAP cubes.

**Self Study Assignment**

1. Compare OLTP and OLAP systems.
2. Study advantages and limitations of OLAP.

| **PRACTICAL NO.05** | | **08 HOURS** |
|---|---|---|

**Practice Lab Assignment**

- Identify key measures and metrics used in Business Intelligence.
- Study aggregate functions used in business analysis.

**Lab Assignment**

- Design Key Performance Indicators (KPIs) for a business scenario.
- Create a dashboard layout showing business performance metrics.

**Self Study Assignment**

1. Study Balanced Scorecard and its role in performance management.
2. Compare descriptive and predictive analytics in BI.

| **PRACTICAL NO.06** | | **06 HOURS** |
|---|---|---|

**Practice Lab Assignment**

- Study the data mining process used in Business Intelligence.
- Identify different data mining models and their purposes.

**Lab Assignment**

- Analyze a business dataset and identify suitable data mining techniques.
- Prepare a report explaining how data mining supports business decisions.

**Self Study Assignment**

1. Study emerging trends in Business Intelligence such as Cloud BI and Big Data Analytics.
2. Identify ethical issues and challenges in Business Intelligence.

**Text Books:**

1. Turban, E., Sharda, R., Delen, D, *Business Intelligence and Analytics: Systems for Decision Support*, Pearson
2. Cindi Howson, *Successful Business Intelligence*, McGraw-Hill
3. Ralph Kimball & Margy Ross, *The Data Warehouse Toolkit*, Wiley.

**REFERENCE BOOKS:**

1. Larissa Moss & Shaku Atre. Business Intelligence Roadmap, Addison-Wisley
2. Alex Berson & Stephen J. Smith, Data Warehousing, Data Mining and OlAP, McGraw-Hill
3. David Loshin. Business Intelligence, The Savvy Managers Guide, Morgan Kaufmann.

**E-Resources:**

1. NPTEL- Business Intelligence and Analytics
2. Microsoft Learn – Business Intelligence Fundamentals
3. Coursera – Business Intelligence & Data Analytics Courses

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| Department Of ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| SECOND YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | MLOPs for AI Practitioner |
| | COURSE CODE | 2311423T |
| | COURSE CREDITS | 3 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 3 | NIL | 40 | NIL | 60 | NIL | NIL | 100 |

Pre-Requisite:

Basic Python Programming Skills
Fundamentals of Machine Learning (training, testing, evaluation)
Basic knowledge of Data Science tools (Jupyter Notebook)
Fundamentals of Version Control (Git)
Basic Command-Line Operations
Willingness to learn Docker, Kubernetes, and Cloud Platforms

Course Objectives:

2311423T.CO1: Understand the fundamentals, evolution, and importance of MLOps.
2311423T.CO2: Explain ML lifecycle management and production challenges.
2311423T.CO3: Apply version control, containerization, and orchestration concepts in ML workflows.
2311423T.CO4: Understand CI/CD pipelines for ML systems.
2311423T.CO5: Analyze monitoring, logging, security, and compliance in MLOps.
2311423T.CO6: Gain hands-on experience with Vertex AI and real-time MLOps projects.

Course Outcomes:

2311423T.CO1: Explain core concepts and architecture of MLOps.
2311423T.CO2: Manage ML lifecycle from experimentation to production deployment.
2311423T.CO3: Use Docker and Kubernetes for scalable ML deployments.
2311423T.CO4: Implement CI/CD pipelines for ML models.

2311423T.CO5: Monitor model performance, drift, and reliability in production.
2311423T.CO6: Design and deploy enterprise-grade ML solutions using Vertex AI.

Course Abstract:

This course provides a comprehensive understanding of Machine Learning Operations (MLOps), focusing on deploying, monitoring, and maintaining machine learning models in production environments. It bridges the gap between data science and DevOps by covering automation, CI/CD pipelines, containerization, orchestration, monitoring, security, and compliance. The course also introduces Google Cloud Vertex AI for managing end-to-end ML workflows, preparing students for real-world enterprise MLOps roles.

| **THEORY COURSE CONTENTS** | | |
|---|---|---|
| **UNIT 1** | **INTRODUCTION TO MLOps FUNDAMENTALS** | **08 HOURS** |
| **Applications / Case Study:** ML Model Deployment Failures in Production<br>**Contents:**<br>Introduction to MLOps – Definition and Scope – Evolution of MLOps – MLOps vs DevOps – Challenges in Production ML – ML Lifecycle (Data Collection to Retraining) – Automation and Reproducibility – Data Drift and Model Decay – Role of MLOps in Enterprise Systems.<br>**Self-Study:** Real-world MLOps use cases<br>**Further Readings:** MLOps in Healthcare and Finance | | |
| **UNIT 2** | **VERSION CONTROL AND COLLABORATION** | **07 HOURS** |
| **Applications / Case Study:** Collaborative ML Development using Git<br>**Contents:**<br>Version Control Concepts – Git Fundamentals (Repositories, Commits, Branches, Merges) – GitHub/GitLab for Collaboration – Experiment Tracking – Data and Model Versioning – DVC and MLflow – Team Collaboration and Branching Strategies.<br>**Self-Study:** Self-service experiment tracking<br>**Further Readings:** GitOps for Machine Learning | | |
| **UNIT 3** | **CONTAINERIZATION WITH DOCKER** | **08 HOURS** |
| **Applications / Case Study:** Containerized ML Model Deployment<br>**Contents:**<br>Containerization Concepts – Containers vs Virtual Machines – Docker Architecture – Creating Docker Images for ML Models – Dependency Management – Best Practices and Security – Docker in CI/CD Pipelines – Preparing Containers for Kubernetes.<br>**Self-Study:** Optimizing Docker images<br>**Further Readings:** Secure Docker for ML workloads | | |
| **UNIT 4** | **ORCHESTRATION USING KUBERNETES** | **08 HOURS** |

**Applications / Case Study:** Scalable ML Inference with Kubernetes

**Contents:**
Kubernetes Overview – Pods, Deployments, Services – Kubernetes Architecture – Deploying ML Pipelines – Auto-scaling ML Workloads – Rolling Updates and Rollbacks – Monitoring and Logging – Integration with CI/CD Pipelines.

**Self-Study:** Kubernetes YAML configurations

**Further Readings:** Enterprise ML on Kubernetes

| UNIT 5 | CI/CD, MONITORING, AND EXPERIMENT TRACKING | 08 HOURS |
|---|---|---|

**Applications / Case Study:** Automated ML Deployment Pipeline

**Contents:**
CI/CD Concepts for ML – Jenkins, GitHub Actions, GitLab CI – Automated Testing of ML Pipelines – Model Monitoring and Logging – Data Drift and Bias Detection – Alerts and Dashboards – Experiment Tracking and Model Registry (MLflow, W&B).

**Self-Study:** Monitoring ML models in production

**Further Readings:** MLOps Observability Tools

| UNIT 6 | VERTEX AI, SECURITY, AND REAL-TIME PROJECTS | 06 HOURS |
|---|---|---|

**Applications / Case Study:** End-to-End ML Pipeline using Vertex AI

**Contents:**
Introduction to Google Cloud Vertex AI – Training and Deployment Pipelines – Model Registry – Feature Store – Security and Compliance – Data Privacy and Access Control – Secrets Management – Capstone Project – Real-Time MLOps Workflows.

**Self-Study:** Vertex AI Pipelines

**Further Readings:** AI Governance and Responsible AI

**Text Books:**

1. Mark Treveil et al., *Introducing MLOps*, O'Reilly Media
2. Noah Gift & Alfredo Deza, *Practical MLOps*, O'Reilly Media

**REFERENCE BOOKS:**

1. Chip Huyen, *Designing Machine Learning Systems*, O'Reilly Media
2. Emmanuel Ameisen, *Building Machine Learning Powered Applications*, O'Reilly Media

**E-Resources:**

1. Google Cloud Vertex AI Documentation
2. Coursera – MLOps Specialization
3. NPTEL – Cloud Computing and AI

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Major Project - I |
| | COURSE CODE | 2304391L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | 4 | NIL | NIL | NIL | 35 | 40 | 75 |

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304391.CO.1: Apply mathematical, scientific, and engineering principles in the design and development of their projects [L3].

2304391.CO.2: Analyze, and solve complex engineering problems, demonstrating proficiency in research methodologies and modern tools [L4].

2304391.CO.3: Assess the societal and environmental impacts of their engineering solutions and incorporate ethical considerations into their projects [L5].

2304391.CO.4: Communicate their project ideas and results effectively through presentations and reports, and work collaboratively in teams [L3].

2304391.CO.5: Apply effective project management skills, including planning, resource allocation, and adherence to timelines, while engaging in continuous learning and improvement [L3].

**GUIDELINES**

1. Every project group should consist of minimum 03 and maximum of 04 students.
2. The group members may be from different programs to support the interdisciplinary functioning.
3. Project group members and title of the project need to be approved by Project Guide and DEPARTMENT .
4. Projects should preferably have a national/international industry/academic/research collabora- tion.
5. User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
6. The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.
7. Define proposed solution and apply project management/modeling tools for project planning and design.
8. Critically analyze various solutions/techniques to solve real world problems and perform feasibility study to select and justify proposed solution.
9. Define outcome, milestones, definite roadmap for project design, implementation, evaluation and documentation.

**Collaborative/Sponsored Project**

Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for project work.

Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization, anytime before the commencement of the sixth semester.

Proposed Collaborative Project work need to reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of minimum 12 months to 18 months.

Final assessment will be carried out in presence of faculty mentor, external mentor and examiner.

**TIMELINE**

1. Exploration of fore front research/specialization areas and opportunities in the various fields.
2. Formation of Project Group. Finalization of area of work/title as per forefront areas.
3. Exploration of abridged courses, valid resources, challenges, relevance with current opportunities.
4. Background study Systematic literature review.
5. Literature review documentation for Project Report and Research Article.
6. Project Review I Presentation.
7. Define problem statement and objectives.
8. Define scope of the work and Outline of the work.
9. Project Design, Modelling, Simulation etc.
10. Proposed Methodology of the solution and its documentation.
11. Project Review II Presentation.
12. Project Documentation: Ethics in Writing
13. Project Documentation: Final Synopsis
14. Project Documentation: Project Report Writing

## ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

Background Study and Literature Review (10 Marks)

Synopsis (5 Marks)

Project Review I: Problem Identification, Motivation, Relevance, Background Study, Literature Review (10 Marks)

Project Review II: Literature Review, Problem Definition, Project Planning, Analysis and Design (10 Marks)

Project Report (10 Marks)

Final Presentation and Demonstration (30 Marks)

## TEXT BOOKS

John M. Nicholas. (2012). *Project Management for Engineering, Business and Technology*. 4th Edition, Butterworth-Heinemann. ISBN 978-0080967042.

Leslie Lamport. (1994). LaTEX: *A document preparation system, User's guide and reference manual*. 2nd Edition, Addison-Wesley. ISBN 978-0201529838.

## REFERENCE BOOKS

Michelle Reid. (2018). *Report Writing (Pocket Study Skills)*. 2nd Edition, Bloomsbury Publish- ing. ISBN 978-0230376557.

Sara Efrat Efron and Ruth David. (2018). *Writing the Literature Review : A Practical Guide*. 1st Edition, Guilford Press , ISBN 978-1462536894 .

## E-RESOURCES

IEEE Open Access Articles
Science Direct Open Access E-Journals
ASME Digital Collections
ASCE (American Society for Civil Engineers)
CSIR-NISCAIR E- journals
Spriger Open Access E-Journals & E-Journals
Shodh Gangotri (Repository of Indian Research in Progress)

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Research Methodology |
| | COURSE CODE | 2304492T |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| 2 | NIL | 35 | NIL | 40 | NIL | NIL | 75 |

**COURSE OBJECTIVES :**

2304492.CEO.1: To enable defining and formulating research approaches towards obtaining solutions to practical problems.

2304492.CEO.2: To facilitate development of scientific oral and written communication skills.

2304492.CEO.3: To comprehend the concepts behind adhering to scientific ethics and values.

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304492.CO.1: Apply the key concepts of research methodology to provide real world solutions [L3].

2304492.CO.2: Analyze the research problems and results to evaluate the methodologies, identify limitations, and draw conclusions [L4].

2304492.CO.3: Apply scientific writing skills for preparing dissertation, research articles and research proposals [L3].

2304492.CO.4: Evaluate the ethical implications of the use of artificial intelligence tools in research, focusing on issues such as data privacy, algorithmic bias, transparency, accountability, and responsible use of AI to ensure fairness and integrity in research results [L5].

**COURSE ABSTRACT:**

Research methodology is a structured and scientific approach used to collect, analyze, and interpret quantitative or qualitative data to answer research questions or test hypotheses. A research methodology is like a plan for carrying out research and helps keep researchers on track by limiting the scope of the research. Several aspects must be considered before selecting an appropriate research methodology, such as research limitations and ethical concerns that may affect your research

A research methodology describes the techniques and procedures used to identify and analyze informa- tion regarding a specific research topic. It is a process by which researchers design their study so that they can achieve their objectives using the selected research instruments. It includes all the important aspects of research, including research design, data collection methods, data analysis methods, and the overall framework within which the research is conducted. While these points can help you understand what is research methodology, you

| THEORY COURSE CONTENTS | | |
|---|---|---|
| **UNIT 1** | **Introduction to Research methodology** | **6 HOURS** |
| **Contents:** Meaning of research, Types of research, Research process, Problem definition, Objectives of research, Research questions, Research design, Approaches to research, Quantitative vs. qualitative approach, Understanding theory, Building and validating theoretical models, Exploratory vs. confir- matory research, Experimental vs theoretical Research, Importance of reasoning in research. | | |
| **UNIT 2** | **Problem formulation** | **8 HOURS** |
| **Contents:** Problem formulation, Conducting literature review, Referencing, Information sources, Information retrieval, Role of libraries in information retrieval, Tools for identifying literatures, Indexing and abstracting services, Citation indexes. | | |
| **UNIT 3** | **Result Analysis** | **6 HOURS** |
| **Contents:** Experimental research, Cause effect relationship, Development of hypothesis, Measurement systems analysis, Error propagation, Validity of experiments , Statistical design of experiments , Field experiments, Data/Variable types & classification, Data collection, Numerical and graphical data analysis, Sampling, Observation, Surveys, Inferential statistics and interpretation of result. | | |
| **UNIT 4** | **Scientific Writing** | **4 HOURS** |
| **Contents:** Preparation of dissertation, research papers and proposals, Tables and illustrations, Guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript, References, citation, and listing system of documents. Ethics of Research, Scientific Misconduct, Forms of Scientific Misconduct. Plagiarism, Unscientific practices in thesis work, IPR: To give an idea about IPR, registration, patents,copyrights, and its enforcement. | | |
| **UNIT 5** | **Artificial Intelligence Tools & Ethics in Research** | **4 HOURS** |

**TEXT BOOKS**

C. R. Kothari (2023). Research Methodology. New Age International Publishers, Fifth Edition, ISBN: 978-9389802559.

Ranjit Kumar (2024). Research Methodology: A Step by Step Guide for Beginners. SAGE Publications, Fourth Edition, ISBN: 978-9351501336.

**Contents:** Role of AI in modern research practices, AI Tools for Data Collection and Analysis, Ethical Considerations in AI for Research, AI, Research Integrity, and Bias, Responsible Use of AI in Research, Future Trends in AI and Research Ethics, NITI Aayog National Strategy for Artificial Intelligence.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| THIRD YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | Internship (Technical) |
| | COURSE CODE | 2304396L |
| | COURSE CREDITS | 2 |
| RELEASE DATE : | REVISION NO | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES | |
| NIL | NIL | NIL | NIL | NIL | NIL | 75 | 75 |

**PRE-REQUISITE :** Knowledge about the communication skills

**COURSE OBJECTIVES :**

2304396.CEO.1: To enhance technical skills and self-directed learning.

2304396.CEO.2: To develop adaptability and resilience in a multicultural or professional environment. 2304396.CEO.3: Critically assess the latest industry trends and design strategies to meet professional requirements effectively.

2304396.CEO.4: Formulate comprehensive problem statements by identifying real-world challenges and proposing innovative solutions.

2304396.CEO.5: Develop and present communication strategies to convey ideas clearly and effectively in both verbal and written forms.

**COURSE OUTCOMES :**

The students after completion of the course will be able to,

2304396.CO.1: Apply technical competencies gained through hands-on training or certification programs to solve discipline-specific engineering problems [L3].

2304396.CO.2: Develop professional behavior by demonstrating teamwork, time management, and eth- ical practices in technical and industrial environments [L5].

2304396.CO.3: Evaluate personal and professional growth through critical analysis of experiential learn- ing and industry training outcomes to support career planning [L5].

2304396.CO.4: Formulate strategies addressing emerging industry needs by integrating advanced tech- nical skills with real-world insights [L4].

2304396.CO.5: Propose solution-oriented approaches to complex problems using multidisciplinary knowledge and practical exposure [L5].

2304396.CO.6: Design and deliver technical presentations and detailed reports that effectively commu- nicate practical insights and certifications to varied audiences [L5].

**INTRODUCTION:**

This internship is designed to equip third year entrants B.Tech. students with essential skills for personal and professional growth. The program emphasizes cultivating professionalism, technical expertise, and real-world problem-solving capabilities, enabling students to thrive in competitive and dynamic landscape. Through this immersive experience, students will develop a comprehensive skill set that includes technical knowledge applied through real-time projects, effective communication, teamwork, and adaptability.

A significant focus of the program is encouraging students to pursue technical certifications in core and emerging domains, thereby enhancing their technical competence and industry readiness. These certifications include, but are not limited to:

- **Programming and Development:** Java, Python, C++, and Advanced Java.
- **Database Management:** Oracle, SQL, and MongoDB.
- **Engineering Design and Simulation:** Autodesk Revit, MATLAB, ANSYS, and AutoCAD.
- **Process Simulation and Optimization:** Aspen HYSYS, Aspen Plus, and CFD (Computational Fluid Dynamics).
- **Data Analytics and Visualization:** Power BI, Tableau, and Excel Advanced Analytics.
- **Cloud Computing and Automation:** AWS (Amazon Web Services), Microsoft Azure, and DevOps Essentials.
- **AI and Machine Learning:** TensorFlow, PyTorch, and introductory courses in AI/ML appli- cations.
- **Digital Tools for Productivity:** Primavera P6 for project management and SolidWorks for design engineering.

By participating in this internship, students will gain hands-on experience in their chosen technical areas, actively apply theoretical knowledge to practical challenges, and build confidence in delivering solutions. The program also emphasizes collaboration and peer learning, helping students to develop essential teamwork skills.

**SCOPE AND STRUCTURE OF SIP:**

**Scope:**

The Student Internship Program in Technical Skills is designed for students entering the third year of the B.Tech. program, to be undertaken during the summer break after Semester IV. This program aims to provide opportunities for skill enhancement through global certifications, technical skills training, or industrial exposure. The internship focuses on helping students identify and engage with relevant learning platforms, small-scale industries, or training opportunities to build competencies essential for academic and professional growth. The program emphasizes fostering technical expertise in core domains while enhancing industry readiness.

**Structure**

- **Duration:** : 3 to 4 weeks (minimum of 100 hours).
- **Timeframe:** Conducted during June-July of each academic year.
- **Nature of Internship:**

1. Technical skills training programs.
2. Industrial training with companies or small-scale industries.
3. Certifications in core technical fields such as programming, database management, design, simula- tion, and data analysis.

- **Facilitation:** MITAoE assists students in identifying and applying for appropriate internships aligned with the program's goals.
- **Mentorship:** Each second-year student will be working under the project guide as a mentor for their internship. Students are encouraged to contact their assigned mentor for guidance and support throughout the internship process, including identifying opportunities, applying for internships, and completing required documentation.

**Internship Format and Personal Development Focus:**

**Individual Internship :**

The program is designed as an individual internship, requiring each student to independently engage in their chosen activity. This ensures personalized learning experiences and targeted skill development. **Student Development Focus :**

Before selecting an internship option, second-year engineering students are encouraged to identify specific areas of technical development they wish to enhance. This may include improving technical competencies, gaining hands-on experience in their core field, or acquiring industry-relevant skills. The program places significant emphasis on pursuing technical certification programs in areas such as programming, database management, engineering design, simulation, data analytics, and more. These certifications will enhance students' technical expertise and provide them with a competitive edge in the industry, preparing them for future academic and career success.

Students are encouraged to align their internship choice with their personal and professional growth goals, ensuring a meaningful and impactful experience. Mentors will provide guidance in identifying

**ASSESSMENT:**

The assessment of the internship will be based on a comprehensive evaluation system that ensures reg- ular progress tracking and outcome-based learning. The components and weightage for the assessment are as follows:

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**Continuous Assessment (CA): Biweekly Progress Reports and interaction with faculty mentor (40%):**

Students must submit at least two progress reports during the internship/training period. Each report should clearly document:

Activities performed

Skills or concepts learned

Challenges faced and strategies used to overcome them

**Detailed Project Report with Learning Outcomes (30%)**

Upon completion of the internship, students are required to submit a comprehensive minimum of 20 to 25 pages' internship/project report. The report must include:

Overview of the Industry/Research Institute

Skills and knowledge acquired (technical/soft/life)

Specific challenges addressed

Personal and professional growth reflections

Clearly stated learning outcomes

The report will be assessed for depth, relevance, structure, and clarity.

**Final Presentation with Certificate (30%):**

Students will deliver a final presentation summarizing their internship experience and learning outcomes.

A valid internship completion certificate from the training organization must be submitted during the presentation.

| MIT \| Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) | COURSE SYLLABUS | |
|---|---|---|
| DEPARTMENT OF ARTIFICIAL INTELLIGENCE | W.E.F | AY: |
| FINAL YEAR BACHELOR OF TECHNOLOGY | COURSE NAME | CYBER SECURITY |
| | COURSE CODE | 2304412T |
| | COURSE CREDITS | 4 |
| RELEASE DATE : | REVISION NO. | |

| TEACHING SCHEME (HOURS/WEEK) | | EXAMINATION SCHEME AND MARKS | | | | | |
|---|---|---|---|---|---|---|---|
| | | THEORY | | | LABORATORY | | TOTAL |
| LECTURE | PRACTICAL | IA | MSE | ESE | CA | PRACT/DEMO/PRES. | |
| 4 | NIL | 60 | NIL | 90 | NIL | NIL | 150 |

**PREREQUISITE :** COMPUTER NETWORKS

**COURSE OUTCOMES :**

After successful completion of the course, students will be able to,

2304412T.CO.1: Explain core cybersecurity principles and apply incident response strategies. [L3].

2304412T.CO.2: Demonstrate hands-on ability to secure networks and systems [L3].

2304412T.CO.3: Apply AI/ML models for threat detection and defense against adversarial attacks [L3].

2304412T.CO.4: Implement computer vision for malware detection and biometric access control [L3].

2304412T.CO.5: Design and secure IoT infrastructures addressing vulnerabilities and privacy [L3].

2304412T.CO.6: Apply cloud security tools and practices to prevent misconfigurations and data leaks [L3].

**COURSE ABSTRACT:**

This course offers a deep dive into modern cybersecurity, covering foundational principles, network de- fenses, AI-driven threat detection, computer vision security, IoT protection, and cloud security. Through real-world case studies and hands-on labs, students learn to analyze attacks, secure systems, and apply cutting-edge tools and techniques. Emphasis is placed on practical skills in threat modeling, adversarial AI, steganography, and secure cloud configurations. By the end of the course, learners will be equipped to build and manage resilient, intelligent, and secure digital environments.

**THEORY COURSE CONTENTS**

| UNIT 1 | FOUNDATIONS OF CYBERSECURITY | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Dissection of the SolarWinds supply chain attack — mapping attack vectors and response strategies.

**Contents:Introduction to Cybersecurity:** Basic concepts, threats, vulnerabilities, and security principles. **Data Security:** Data encryption, access control and data loss prevention.**Application Security:** Secure development practices, input validation.**Ethical Hacking:** Understanding how at- tackers think and testing security measures. **Incident Response:** Procedures for handling security breaches. **Lab:** Network analysis using Wireshark and threat modeling with STRIDE

**Self Study:** History of major cyber attacks (e.g., Stuxnet, Equifax breach) ,CIA Triad
**Further Readings:** Advanced Persistent Threats (APT), Security Information and Event Manage- ment (SIEM)

| UNIT 2 | NETWORK AND SYSTEM SECURITY | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Analysis of the Dyn DNS DDoS attack via IoT devices — securing endpoints and networks.

**Contents:** Firewalls, IDS/IPS, Zero Trust Architecture. Common attacks: DDoS, Man-in-the-Middle (MITM), Endpoint security and patch management

**Lab:** Simulate DDoS using LOIC, firewall configuration

**Self Study:**Packet inspection and protocol layers (OSI model), Network segmentation and VLANs

**Further Readings:**Intrusion Detection Using Deep Learning,Software-Defined Perimeter (SDP).

| UNIT 3 | INTELLIGENT SECURITY SYSTEMS: AI TECHNIQUES | 10 HOURS |
|---|---|---|

**Applications/Case Study:**Attacking an image classifier with adversarial inputs — evasion and mit- igation techniques.

**Contents:AI and ML Fundamentals:** Understanding machine learning algorithms, neural net- works, and other AI techniques. **AI-Driven Threat Detection:** Using AI to identify and prevent malicious activity. **Anomaly Detection**: Detecting unusual patterns in network traffic or system behaviour.**Adversarial AI:** Understanding how AI models can be manipulated and how to defend against adversarial attacks.**AI-Powered Security Solutions:** Exploring various AI-based security tools and technologies. **Lab:** Perform an FGSM adversarial attack on a CNN model using PyTorch or TensorFlow

**Self Study:** Basics of supervised vs unsupervised learning, Confusion matrix and ROC curves for model evaluation, Adversarial example generation techniques

**Further Readings:**Explainable AI (XAI) for Cybersecurity, Transfer Learning in Threat Detection.

| UNIT 4 | SECURING SYSTEMS WITH COMPUTER VISION | 10 HOURS |
|---|---|---|

**Applications/Case Study:**Multi-Layered Threat Detection and Access Control Using Computer Vision Techniques.

**Contents: Computer Vision Fundamentals:**Understanding image processing, object recognition, and machine vision techniques. **Malware Detection in Images:** Using computer vision to identify malware embedded in images, especially in phishing emails. **Image-Based Anomaly Detection:** Using computer vision to detect unusual patterns in visual data, like network traffic or video footage. **Facial Recognition for Access Control:** Implementing facial recognition systems for secure access to physical and digital environments.

**Lab:** Malware Detection in Images (Steganography Analysis)

**Self Study:** Image classification vs object detection, Common CV architectures (e.g., CNNs, YOLO, ResNet), Introduction to steganography and digital watermarking

**Further Readings:**Deepfake Detection Techniques, Vision-Based Behavioral Biometrics, 3D Facial

Recognition and Spoofing Countermeasures

| UNIT 5 | BUILDING RESILIENT IOT SYSTEMS | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Exploiting the Mirai botnet — understanding how unsecured IoT devices are hijacked.

**Contents: IoT Security Fundamentals:** Understanding the vulnerabilities of IoT devices and net- works. **Securing IoT Devices:** Implementing security measures for IoT devices, including authen- tication, encryption, and intrusion detection.**IoT Network Security:** Securing the communication channels and protocols used by IoT devices. **Data Privacy in IoT:** Addressing privacy concerns related to the collection, storage, and use of data from IoT devices. **IoT Device Security Manage- ment:** Managing the security of a large number of IoT devices.

**Lab:** Firmware extraction and basic analysis using Binwalk; scan IoT devices via Shodan

**Self Study:** IoT protocols: MQTT, CoAP. Common IoT OS platforms: RIOT, Contiki.Device hard- ening and secure boot

**Further Readings:** Secure Boot and Trusted Execution Environment (TEE),Blockchain for IoT Se-
curity and Authentication, AI-Powered Intrusion Detection for IoT Networks.

| UNIT 6 | CLOUD AND QUANTUM SECURITY | 10 HOURS |
|---|---|---|

**Applications/Case Study:** Case of Uber's S3 bucket data leak — how misconfigurations led to massive data exposure.

**Contents:** Introduction to Cloud Computing, Types of Cloud Computing : Public, Private and Hy- brid, Cloud service models (IaaS, PaaS, SaaS), Identity Access Management (IAM), encryption, audit logs, **Cloud security tools:** AWS Inspector, GCP Security Command Center.**Quantum Comput- ing and Security:**Overview of Quantum Computing fundamentals,Threats to classical encryption by quantum algorithms (e.g., Shor's algorithm),Post-quantum cryptography and future-safe cryptographic standards.

**Lab:** Implement RBAC and encryption in AWS free tier **Self Study:**Cloud misconfiguration risks and prevention, IAM policies and RBAC vs ABAC. Cloud-native threat modeling

**Further Readings:** Cloud Security Posture Management (CSPM).

## TEXT BOOKS

William Stallings, Lawrie Brown (2018). *Computer Security: Principles and Practice.* 4th Edition, Pearson. ISBN: 9780134794105.

Mark Stamp (2020). Information Security: *Principles and Practice.* 3rd Edition, Wiley. ISBN: 9781119570485.

Al-Sakib Khan Pathan (2016). *Security of Internet of Things: Challenges and Solutions.* CRC Press. ISBN: 9781138031784.

Tim Mather, Subra Kumaraswamy, Shahed Latif (2009). *Cloud Security and Privacy.* O'Reilly Media. ISBN: 9780596802769.

## REFERENCE BOOKS

Clarence Chio, David Freeman (2018). *Machine Learning and Security: Protecting Systems with Data and Algorithms.* O'Reilly Media. ISBN: 9781491979907.

William Stallings (2013). *Network Security Essentials: Applications and Standards.* 4th Edition, Pearson. ISBN: 9780133370430.

Mohamed Elgendy (2020). *Deep Learning for Vision Systems. Manning Publications.* ISBN: 9781617296192.

Bruce Schneier (2015). *Applied Cryptography: Protocols, Algorithms, and Source*

## E-RESOURCES

OWASP (Open Web Application Security Project) – https://owasp.org

Shodan (IoT Device Search Engine) – https://www.shodan.io

Wireshark Official Documentation – https://www.wireshark.org/docs/

AWS Security Documentation – https://docs.aws.amazon.com/security

**Outline of Question paper**

The question paper format with common instructions shall be provided to the paper setter.

around 40 percent of each paper should be structured viz questions could be set from book work, or be of similar type and difficulty as questions used in tutorials, or consist of a number of part-questions requiring brief answers

50 per cent should be testing the ability of students to apply what is taught in the class to various real-life situations (maybe case study type of questions)

10 percent of the questions should comprise of abstract questions i.e. questions related to the subject but from topics which may or may not be included in the curriculum. It should test the general reading done by the students over and above the published course content (self- learning)

Straightforward' questions or parts of questions: these are aimed at testing principles and students' basic knowledge and understanding. The average student who has worked well should have no difficulty in obtaining 40% of the total marks for the paper from the straightforward parts. These should address the first three levels of the Blooms Taxonomy - namely remembering, understanding and applying.

More difficult' questions or parts of questions: These will require extra thought and / or understanding than 'straightforward' questions, or more specialized knowledge. These will be based on the Higher order thinking skills defined by Blooms Taxonomy viz questions based on analyzing, evaluating and creating

**Setting Questions:**

a) These guidelines relate to a 2-hour prescribed marks examination paper in which all questions must be answered. The questions do not need to carry the same marks.
b) It is assumed that 30 minutes will be available, on average, per question, leaving 30 minutes for reading the examination paper and for final checking etc.
c) Quantitative questions: A suggested guide for length of quantitative questions is that it should take the examiner (who knows what the answer should be) 15 minutes to write down his specimen answer in a form which would be acceptable for the award of maximum marks.
This will ensure that the examinee has 50% thinking time to go with 50% writing and calculating time
d) Descriptive questions: For purely descriptive questions the examiner should base the question on about 20 minutes writing time for the student, i.e., about two thirds of the time available. Descriptive questions should be carefully set so that students must indicate understanding of the particular subject.
e) Multi-part questions: These have many advantages but should conform broadly to the following principles-

- Errors in an early part should not significantly prejudice the gaining of marks for subsequent parts
- A mixture of 'straightforward' and 'more difficult' parts may be used to adjust overall difficulty level. If possible, the easier parts should come first.
- The marking schedule should be even between parts unless stated otherwise, when the marks available should be clearly indicated

f) Model answers: Clearly written and well-presented model answers (solution set) are expected from examiners and should accompany the question paper when submitted.
g)Nature of the question paper should be precise. The paper setter should design the question paper such that the questions are unambiguous, are written in simple and

meaningful words, should be asked for appropriate marks and should cover the entire syllabus prescribed for the course.

h) A scheme of marking, giving distribution of marks for different points in the question shall be included in the question paper for the guidance of the examinees as well as for the examiners assessing the answer books.

i) The paper setter should specifically mention the Charts, Tables, other documents / data books etc. The use of which shall be permitted during the actual conduct of the examination. Pre-printed data sheets maybe provided as per need, to be used by students during the examinations.

j) The faculty shall not write any instructions in the question paper that will violate the examination rules.

**SET A**

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Reg. No:

**End Semester Examination - December 2025**

| | | | |
|---|---|---|---|
| Programme | | Date of Examination | |
| Course Code | | Semester | |
| Course Name | | Total No. of Questions | |
| Class | | Pattern | **2023 REGULAR PATTERN** |
| Time | **2 hours** | Max. Marks | |

Instructions To Candidates

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed.
3. Black figures to the right indicate full marks.

**Bloom Level(BL):** 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

| **Answer the following Questions (Answer all Question (s) and all its parts only)** | **Marks** | **CO** | **BL** |
|---|---|---|---|
| **Q1.** | **10** | **1** | **2** |
| **Q2.** | **10** | **2** | **3** |
| **Q3.** | **10** | **3** | **3** |

In the TOS, first you have to plan the distribution of 100 marks into the respective COs.

L3 L3 L3 L6 L5 Table 1

In Category 2, the distribution of questions for the respective COs in a tabular form should be presented. Prepare 6 tables ( one for each CO)

CO 5: Explain software quality standards [L2]

| Cognitive level / Knowledge Domain | L1 remember | L2 Understand | L3 Apply | L4 Analyse | L5 Evaluate | L6 Create |
|---|---|---|---|---|---|---|
| Factual | | | | | | |
| Conceptual | | | | | | |
| Procedural | | | | | | |
| Meat Cognitive | | | | | | |

LOTS ( Lower Order Thinking skills)
HOTS (Higher Order thinking Skills)

Thenumberswritten like1(2), where thefirst numberindicatethequestionnumber andthe number in bracket indicating the marks for the particular question.

Category 3: Distribution of marks as per the cognitive levels

This is combined input of all the 6 tables under category 2,

In the TOS(Table of Specification), first you have to plan the distribution of marks into the respective COs.

L3
L3 Table 1
L
3
L
6
L
5

In Category 2, the distribution of questions for the respective COs in a tabular form should be presented.
Prepare 6 tables ( one for each CO)

CO 4: Create Test cases for different testing techniques using testing tools[L6]

| Cognitive level / Knowledge Domain | L1 remember | L2 Understand | L3 Apply | L4 Analyse | L5 Evaluate | L6 Create |
|---|---|---|---|---|---|---|
| Factual | | | | | | |
| Conceptual | | | | | | |
| Procedural | | | | | | |
| Meat Cognitive | | | | | | |

LOTS ( Lower Order Thinking skills)
HOTS (Higher Order thinking Skills)

Thenumberswritten like1(2), where thefirst numberindicatethequestionnumber andthe number in bracket indicating the marks for the particular question.

Category 3: Distribution of marks as per the cognitive levels
This is combined input of all the 6 tables under category