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**MIT** | Academy of  
Engineering

**MIT ACADEMY OF ENGINEERING, ALANDI**

An Autonomous Institute Affiliated to

**Savitribai Phule Pune University**

**Curriculum**

**For**

**Bachelor of Technology**

**In**

**Mechanical Engineering**

**(Choice Based Credit System)**

**2016-2020**



**BoS Chairman**  
(Dean, School of  
Mechanical & Civil  
Engineering)



**Member Secretary**  
Academic Council  
(Dean, Academics)



**Chairman**  
Academic Council  
(Director, MITAoE)

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**CHAIRMAN**

BOS-Mechanical Engineering  
MIT Academy of Engineering  
(An Autonomous Institute)

# MIT Academy of Engineering

An autonomous institute affiliated to Savitribai Phule Pune University

## CURRICULUM FRAMEWORK- (MECHANICAL ENGINEERING)

The B. Tech Program shall be based on the following type of courses

SL. NO.	TYPE OF COURSE	ABBREVIATION
1.	Natural Science	NSC
2.	Engineering Science	ESC
3.	Program Core	PC
4.	Discipline Core	DC
5.	Department Elective	DE
6.	Open Elective	OE
7.	Humanities and Social Science	HSS
8.	Skill Development and Project	SDP

The Course and Credit Distribution shall be as under,

SL. NO.	TYPE OF COURSE	NO. OF COURSES	TOTAL CREDITS	
			NO.	%
1.	Natural Science	4	18	10.96
2.	Engineering Science	4	16	9.76
3.	Program Core	5	19	11.59
4.	Discipline Core	12	48	29.27
5.	Department Elective	2	6	3.66
6.	Open Elective	4	16	9.76
7.	Humanities and Social Science	8/9	17	10.37
8.	Skill Development and Project	10/9	24	14.63
<b>TOTAL</b>		<b>49</b>	<b>164</b>	<b>100</b>

<b>COURSE DISTRIBUTION: SEMESTER WISE</b>										
<b>SL. NO.</b>	<b>TYPE OF COURSE</b>	<b>NO. OF COURSES/SEMESTER</b>								<b>TOTAL</b>
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	
1.	Natural Science	2	2							<b>4</b>
2.	Engineering Science	2	2							<b>4</b>
3.	Program Core			3	2					<b>5</b>
4.	Discipline Core			2	2	3	3	1	1	<b>12</b>
5.	Department Elective							1	1	<b>2</b>
6.	Open Elective					1	1	1	1	<b>4</b>
7.	Humanities & Social Science	1	1		1	1	2	1/2	2	<b>8/9</b>
8.	Skill Development & Project	1	1	1	1	1	1	2/3	1	<b>9/10</b>
<b>TOTAL</b>		<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>7</b>	<b>5</b>	<b>6</b>	<b>49</b>

<b>CREDIT DISTRIBUTION: SEMESTER WISE</b>										
<b>1 Lecture hour = 1 Credit 2 Lab Hours = 1 Credit 1 Tutorial Hour = 1 Credit</b>										
<b>SL. NO.</b>	<b>TYPE OF COURSE</b>	<b>NO. OF CREDITS/SEMESTER</b>								<b>TOTAL</b>
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	
1.	Natural Science	9	9							<b>18</b>
2.	Engineering Science	8	8							<b>16</b>
3.	Program Core			11	8					<b>19</b>
4.	Discipline Core			8	8	12	12	4	4	<b>48</b>
5.	Department Elective							3	3	<b>6</b>
6.	Open Elective					4	4	4	4	<b>16</b>
7.	Humanities & Social Science	2	2		3	2	3	2	3	<b>17</b>
8.	Skill Development & Project	2	2	2	2	2	2	8	4	<b>24</b>
<b>TOTAL</b>		<b>21</b>	<b>21</b>	<b>21</b>	<b>21</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>18</b>	<b>164</b>

**SCHOOL OF MECHANICAL & CIVIL  
ENGINEERING**

**W. E. F** : 2016-17

**FY BTECH**

**RELEASE DATE** : 01/06/2016

**DEPARTMENT OF MECHANICAL ENGG**

**REVISION NO.** : 0.0

**SEMESTER: I**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P/T*	CREDIT
1.	NSC1	AS101	Mathematics – I	4	1	5
2.	NSC2	AS102/ AS103	Physics/ Chemistry	3	2	4
3.	ESC1	EX101/ CV101	Electrical & Electronics Engg/ Applied Mechanics	3	2	4
4.	ESC2	ME101/ IT101	Engineering Graphics/ Computer Programming	2	4	4
5.	HSS1	HP101	Language & Communication – I	1	2	2
6.	SDP1	ME102/ ME103	Experimental Tools & Techniques/ Design Thinking	--	4	2
<b>TOTAL</b>				13	15	21

**SEMESTER: II**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P/T	CREDIT
1.	NSC3	AS101	Mathematics – II	4	1	5
2.	NSC4	AS103/ AS102	Chemistry/ Physics	3	2	4
3.	ESC3	CV101/ EX101	Applied Mechanics/ Electrical & Electronics Engg	3	2	4
4.	ESC4	IT101/ ME101	Computer Programming/ Engineering Graphics	2	4	4
5.	HSS2	HP101	Language & Communication – II	1	2	2
6.	SDP2	ME103/ ME102	Design Thinking/ Experimental Tools & Techniques	--	4	2
<b>TOTAL</b>				13	15	21

L: Lecture, P: Practical, T:Tutorial; \*Applicable for FY BTech

**SCHOOL OF MECHANICAL & CIVIL  
ENGINEERING**

**W. E. F** : 2017-18

**S Y B TECH**

**RELEASE DATE** : 01/06/2017

**DEPARTMENT OF MECHANICAL ENGG**

**REVISION NO.** : 0.0

**SEMESTER: I**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	PC1	CH201	Environmental Science	2	2	3
2.	PC2	AS201	Applied Mathematics	3	2	4
3.	PC3	ET201	System Engineering	3	2	4
4.	DC1	ME202	Thermal Engineering	3	2	4
5.	DC2	ME203	Solid Mechanics	3	2	4
6.	SDP3	ET206	Prototyping	--	4	2
<b>TOTAL</b>				14	14	21

**SEMESTER: II**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	PC4	IT201	Engineering Informatics	3	2	4
2.	PC5	ME201	Materials Engineering	3	2	4
3.	DC3	ME211	Fluid Mechanics	3	2	4
4.	DC4	ME212	Manufacturing Technology	3	2	4
5.	HSS3	HP201	Psychology	3	--	3
6.	SDP4	ME213	Minor Project	--	4	2
<b>TOTAL</b>				15	12	21

*L: Lecture, P: Practical*

**SCHOOL OF MECHANICAL & CIVIL  
ENGINEERING**

**W. E. F** : 2018-19

**T Y B TECH**

**RELEASE DATE** : 01/12/2017

**DEPARTMENT OF MECHANICAL ENGG**

**REVISION NO.** : 0.0

**SEMESTER: V**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC5	ME301	Machine Design	3	2	4
2.	DC6	ME302	Machines & Mechanisms	3	2	4
3.	DC7	ME303	Heat Transfer	3	2	4
4.	OE1	ME31#	Open Elective - Refer Annexure.	3	2	4
5.	HSS5	HP302	Professional Skills	--	4	2
6.	SDP5	ME30#	Skill Development Lab - Refer Annexure	--	4	2
<b>TOTAL</b>				12	16	20

**SEMESTER:VI**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC8	ME321	Turbomachines	3	2	4
2.	DC9	ME322	Quality Assurance	3	2	4
3.	DC10	ME323	Operations Research	3	2	4
4.	OE2	ME33#	Open Elective - Refer Annexure.	3	2	4
5.	HSS6	HP303	Basics of Entrepreneurship	--	2	1
6.	HSS4	HP301	Project Management	1	2	2
7.	SDP6	ME324	Mini Project	--	4	2
<b>TOTAL</b>				13	16	21

L: Lecture, P: Practical

**SCHOOL OF MECHANICAL & CIVIL  
ENGINEERING**

**W. E. F : 2019-20**

**B TECH**

**RELEASE DATE : 01/12/2018**

**DEPARTMENT OF MECHANICAL ENGG**

**REVISION NO. : 0.0**

**SEMESTER: VII**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC11	ME401	Heating Ventilation & Air Conditioning	3	2	4
2.	DE1	ME41#	Discipline Elective - Refer Annexure.	3	--	3
3.	OE3	ME42#	Open Elective - Refer Annexure.	3	2	4
4.	HSS7	HP402	Sociology	2	--	2
5.	HSS8/ SDP7	HP403/ ME40#	Business Strategies / Piping Design/ Six Sigma/ Energy Audit	--	2	1
6.	SDP8	ME402	Project - I	--	8	4
7.	SDP9	ME404	Summer Internship	--	--	4
<b>TOTAL</b>				11	14	22

**SEMESTER: VIII**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC12	ME431	Noise Vibration & Harshness	3	2	4
2.	DE2	ME44#	Discipline Elective - Refer Annexure	3	--	3
3.	OE4	ME45#	Open Elective - Refer Annexure	3	2	4
4.	HSS9	HP401	Engineering Economics	2	--	2
5.	SDP10	ME432	Project - II	--	8	4
<b>TOTAL</b>				11	12	17

*L: Lecture, P: Practical*

<b>CREDITS</b>				
<b>1 Lecture hour = 1 Credit 2 Lab Hours = 1 Credit 1 Tutorial Hour = 1 Credit</b>				
<b>SL. No.</b>	<b>YEAR</b>	<b>SEMESTER</b>		<b>TOTAL</b>
		<b>1</b>	<b>2</b>	
1.	First Year	21	21	<b>42</b>
2.	Second Year	21	21	<b>42</b>
3.	Third Year	20	21	<b>41</b>
4.	Final Year	22	17	<b>39</b>
<b>TOTAL</b>				<b>164</b>

<b>CONTACT HOURS</b>				
<b>SL. No.</b>	<b>YEAR</b>	<b>SEMESTER</b>		<b>TOTAL</b>
		<b>1</b>	<b>2</b>	
1.	First Year	28	28	<b>56</b>
2.	Second Year	28	27	<b>55</b>
3.	Third Year	28	29	<b>57</b>
4.	Final Year	25	23	<b>48</b>
<b>TOTAL</b>				<b>216</b>



## ANNEXURE

<b>Natural Science (NSC): 4 Courses</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Name of Course</b>
1.	AS101	Mathematics – 1
2.	AS104	Mathematics – 2
3.	AS102	Physics
4.	AS103	Chemistry

<b>Engineering Science (ESC): 4 Courses</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Name of Course</b>
1.	EX101	Electrical and Electronics Engineering
2.	ME101	Engineering Graphics
3.	CV101	Applied Mechanics
4.	IT101	Computer Programming

<b>Program Core (PC): 5 Courses</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Name of Course</b>
1.	CH201	Environmental Science
2.	AS201	Applied Mathematics
3.	ET201	System Engineering
4.	IT201	Engineering Informatics
5.	ME201	Materials Engineering

<b>Discipline Core (DC): 12 Courses</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Name of Course</b>
1.	ME202	Thermal Engineering
2.	ME203	Solid Mechanics
3.	ME211	Fluid Mechanics
4.	ME212	Manufacturing Technology
5.	ME301	Machine Design
6.	ME302	Machines & Mechanisms
7.	ME303	Heat Transfer
8.	ME321	Turbomachines
9.	ME322	Quality Assurance
10.	ME323	Operations Research
11.	ME401	Heating Ventilation & Air Conditioning
12.	ME431	Noise Vibration & Harshness

<b>Department Elective (DE): 2 Courses</b>		
	<b>Course Code</b>	<b>Name of Course</b>
1.	ME411	Mechatronics
	ME412	Pressure Vessel Design
	ME413	Power Plant Engineering
	ME414	Product Lifecycle Management
2.	ME441	Hydraulics & Pneumatics
	ME442	Mechanical System Design
	ME443	Non-Conventional Machining
	ME444	Enterprise Resource Planning

**Open Elective (OE): 4 Courses**

	<b>Sl. No.</b>	<b>Course Code</b>	<b>Name of Course</b>
Computer Aided Engineering	1.	ME311	Geometric Modeling & Design
	2.	ME331	Finite Element Analysis
	3.	ME421	Computational Fluid Dynamics
	4.	ME451	Advanced Engineering Analysis
Robotics & Automation	1.	ME312	Fundamentals of Robotics
	2.	ME332	Kinematics & Dynamics of Robots
	3.	ME422	Robotics Vision and Control
	4.	ME452	Intelligent and High Performance Robotics
Industrial Engineering & Management	1.	ME313	Work Process Assessment
	2.	ME333	Facility Planning & Design
	3.	ME423	Operations Management
	4.	ME453	Supply Chain Management

**Open Elective (OE): Term - I**  
**(List of courses for Academic Year 2018-19)**

<b>Chemical</b>		
1	CH311	Process Modeling and Simulation.
2	CH312	Piping Engineering
<b>Civil</b>		
3	CV311	Construction Planning & Management
<b>Computer</b>		
4	IT311	Cryptography & System Security
5	CS311	Descriptive Analytics
6	CS312	Artificial Intelligence & Neural Network
<b>Electronics</b>		
7	EX311	Fundamentals of Robotics
<b>E &amp; TC</b>		
8	ET311	Embedded System Programming (ESP)
9	ET312	IoT Architecture and Protocols
<b>IT</b>		
10	IT311	Cryptography & System Security
11	CS311	Descriptive Analytics
12	CS312	Artificial Intelligence & Neural Network
<b>Mechanical</b>		
13	ME311	Geometric Modeling & Design
14	ME312	Fundamentals of Robotics
15	ME313	Work Process Assessment

**Open Elective (OE): Term - II  
(List of courses for Academic Year 2018-19 )**

<b>Chemical</b>		
1	CH331	Process Engineering.
2	CH332	Piping Layout
<b>Civil</b>		
3	CV331	Operation Research
<b>Computer</b>		
4	IT331	Cyber Security
5	CS331	Data Science-I
6	CS332	Machine Learning
<b>Electronics</b>		
7	EX331	Kinematics and Dynamics of Robotics
<b>E &amp; TC</b>		
8	ET331	Embedded Processor
9	ET332	IoT Network & Protocols
<b>IT</b>		
10	IT331	Cyber Security
11	CS331	Data Science-I
12	CS332	Machine Learning
<b>Mechanical</b>		
10	ME331	Finite Element Analysis
11	ME332	Kinematics & Dynamics of Robots
12	ME333	Facility Planning & Design

**Open Elective (OE): Term - I**  
**(List of courses for Academic Year 2019-20 )**

<b>Chemical</b>		
1	CH421	Process Optimization
2	CH422	Piping Design & Engineering
<b>Civil</b>		
3	CV421	Financial Management
<b>Computer</b>		
4	IT421	Ethical Hacking & Cyber Laws
5	CS421	Data Science-II
6	CS422	Pattern Recognition
<b>Electronics</b>		
7	EX421	Robotics Vision and Control
<b>E &amp; TC</b>		
8	ET421	Low-Power SoC Architecture & Applications (SoC&A)
9	ET422	Privacy and Security in IoT
<b>IT</b>		
10	IT421	Ethical Hacking & Cyber Laws
11	CS421	Data Science-II
12	CS422	Pattern Recognition
<b>Mechanical</b>		
13	ME421	Computational Fluid Dynamics
14	ME422	Robotics Vision and Control
15	ME423	Operations Management

**Open Elective (OE): Term - II**  
**(List of courses for Academic Year 2019-20 )**

<b>Chemical</b>		
1	CH451	Process Intensification & Integration
2	CH452	Pipeline Engineering
<b>Civil</b>		
3	CV451	Visualization & Information Exchange
<b>Computer</b>		
4	IT451	Cyber Forensics
5	CS451	Practitioner's approach for Data analytics
6	CS452	Reinforcement Learning
<b>Electronics</b>		
7	EX451	Intelligent and High Performance Robotics
<b>E &amp; TC</b>		
8	ET451	Real-Time Embedded System (RES)
9	ET452	Energy Management for IoT Devices
<b>IT</b>		
10	IT451	Cyber Forensics
11	CS451	Practitioner's approach for Data analytics
12	CS452	Reinforcement Learning
<b>Mechanical</b>		
13	ME451	Advanced Analysis
14	ME452	Intelligent and High Performance Robotics
15	ME453	Supply Chain Management

<b>Humanities and Social Science (HSS): 9 Courses</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Name of Course</b>
1.	HP101	Language & Communication – I
2.	HP102	Language & Communication – II
3.	HP201	Psychology
4.	HP301	Project Management
5.	HP302	Professional Skills
6.	HP303	Basics of Entrepreneurship
7.	HP401	Engineering Economics
8	HP402	Sociology
9	HP403	Business Strategies

<b>Skill Development and Project (SDP): 10 Courses</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Name of Course</b>
1.	ME102	Engineering Tools and Techniques
2.	ME103	Design Thinking
3.	ET206	Prototyping
4.	ME213	Minor Project
5.	ME304	Skill Development Lab (Autodesk Inventor)
	ME305	Skill Development Lab (CATIA)
6.	ME403	Piping Design
	ME404	Six Sigma
	ME405	Energy Audit
7.	ME324	Mini Project
8.	ME402	Project - I
9.	ME406	Summer Internship
10.	ME432	Project - II



**SCHOOL OF MECHANICAL & CIVIL  
ENGINEERING**

**W. E. F** : 2019-20 (PART B)

**FINAL YEAR BACHELOR OF  
TECHNOLOGY MECHANICAL  
ENGINEERING**

**RELEASE DATE** : 01/12/2018

**REVISION NO.** : 0.0

**SEMESTER: VII**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC11	ME401	Heating Ventilation & Air Conditioning	3	2	4
2.	DE1	ME41#	Discipline Elective	3	--	3
3.	OE3	ME42#	Open Elective	3	2	4
4.	HSS7	HP402	Sociology	2	--	2
5.	HSS8/ SDP7	HP403/ ME40#	Business Strategies / Piping Design/ Six Sigma/ Energy Audit	--	2	1
6.	SDP8	ME402	Project – I	--	8	4
7.	SDP9	ME404	Summer Internship	--	--	4
<b>TOTAL</b>				11	14	22

**SEMESTER: VIII (SLIP not in line with the Open elective)**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC12	ME431	Noise Vibration & Harshness <sup>@</sup>	3	2	4
2.	DE2	ME44#	Discipline Elective	3	--	3
3.	OE4	ME45#	Open Elective <sup>@</sup>	3	2	4
4.	SEMESTER LONG INTERNSHIP – Project Design			--	6	3
5.	SEMESTER LONG INTERNSHIP – Project Implementation			--	6	3
<b>TOTAL</b>				7	20	17

**SCHOOL OF MECHANICAL & CIVIL  
ENGINEERING**

**W. E. F** : 2019-20 (PART C)

**FINAL YEAR BACHELOR OF  
TECHNOLOGY MECHANICAL  
ENGINEERING**

**RELEASE DATE** : 01/12/2018

**REVISION NO.** : 0.0

**SEMESTER: VII**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC11	ME401	Heating Ventilation & Air Conditioning	3	2	4
2.	DE1	ME41#	Discipline Elective	3	--	3
3.	OE3	ME42#	Open Elective	3	2	4
4.	HSS7	HP402	Sociology	2	--	2
5.	HSS8/ SDP7	HP403/ ME40#	Business Strategies / Piping Design/ Six Sigma/ Energy Audit	--	2	1
6.	SDP8	ME402	Project – I	--	8	4
7.	SDP9	ME404	Summer Internship	--	--	4
<b>TOTAL</b>				11	14	22

**SEMESTER: VIII (SLIP not inline with the Open elective)**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC12	ME431	Noise Vibration & Harshness <sup>@</sup>	3	2	4
2.	DE2	SWAYAM/ NPTEL	Discipline Elective	3	--	3
3.	SEMESTER LONG INTERNSHIP – Project Design			--	10	5
4.	SEMESTER LONG INTERNSHIP – Project Implementation			--	10	5
<b>TOTAL</b>				6	22	17

<b>DEPARTMENT ELECTIVE ON MOOCS PLATFORM</b>			
<b>SR. NO.</b>	<b>COURSE DETAILS</b>	<b>MOOC DETAILS</b>	<b>NO. OF WEEKS</b>
1.	Fundamentals of Industrial Oil Hydraulics and Pneumatics by Prof. R.N. Maiti, IIT Kharagpur	SWAYAM	8
2.	Design for Quality, Manufacturing and Assembly by Prof. Palaniappaan Ramu, IIT Madras	SWAYAM	12
3.	Non-Traditional Abrasive Machining Processes- Ultrasonic, Abrasive Jet and Abrasive Water Jet Machining by Prof. Asimava Roy Choudhury, IIT Kharagpur	SWAYAM	8
4.	Enterprise Resource Planning (ERP) BY Sara Behdad, The State University of New York	COURSERA	4



**MIT ACADEMY OF ENGINEERING, ALANDI**

**An Autonomous Institute Affiliated to**

**Savitribai Phule Pune University**

**Curriculum**

**For**

**First Year**

**Bachelor of Technology**

**2016-2020**

**(With Effect from Academic Year: 2016-2017)**

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**SCHOOL OF MECHANICAL & CIVIL  
ENGINEERING**

**W. E. F : 2016-17**

**FY BTECH**

**RELEASE DATE : 01/06/2016**

**DEPARTMENT OF MECHANICAL ENGG**

**REVISION NO. : 0.0**


**SEMESTER: I**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P/T*	CREDIT
1.	NSC1	AS101	Mathematics – I	4	1	5
2.	NSC2	AS102/ AS103	Physics/ Chemistry	3	2	4
3.	ESC1	EX101/ CV101	Electrical & Electronics Engg/ Applied Mechanics	3	2	4
4.	ESC2	ME101/ IT101	Engineering Graphics/ Computer Programming	2	4	4
5.	HSS1	HP101	Language & Communication – I	1	2	2
6.	SDP1	ME102/ ME103	Experimental Tools & Techniques/ Design Thinking	--	4	2
<b>TOTAL</b>				13	15	21

**SEMESTER: II**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P/T	CREDIT
1.	NSC3	AS101	Mathematics – II	4	1	5
2.	NSC4	AS103/ AS102	Chemistry/ Physics	3	2	4
3.	ESC3	CV101/ EX101	Applied Mechanics/ Electrical & Electronics Engg	3	2	4
4.	ESC4	IT101/ ME101	Computer Programming/ Engineering Graphics	2	4	4
5.	HSS2	HP101	Language & Communication – II	1	2	2
6.	SDP2	ME103/ ME102	Design Thinking/ Experimental Tools & Techniques	--	4	2
<b>TOTAL</b>				13	15	21

*L: Lecture, P: Practical, T:Tutorial; \*Applicable for FY BTech*

 <b>Academy of Engineering</b> (An Autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2016 - 2017</b>
<b>FIRST YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>	Mathematics I
		<b>COURSE CODE</b>	AS101
		<b>COURSE CREDITS</b>	5
<b>RELEASED DATE : 01/06/2016</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
4	1	40	50	10	25	Nil	125

**PRE-REQUISITE :** Basic elementary Mathematics of XI & XII

**COURSE OBJECTIVES :**

AS101.CEO.1: To recall and apply the methods of solving system of equations using matrices.  
 AS101.CEO.2: To find nth derivative and expansion of different functions.  
 AS101.CEO.3: To classify and solve first order ordinary differential equations.  
 AS101.CEO.4: To categorize and inspect the applications of first order differential equations.  
 AS101.CEO.5: To apply the concepts of partial differentiation.  
 AS101.CEO.6: To demonstrate an understanding towards the applications of partial differentiation.

**COURSE OUTCOMES :**

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

AS101.CO.1: Inspect system of equations using matrices. [L4]  
 AS101.CO.2: Illustrate problems based on nth derivative and expansion of functions. [L2]  
 AS101.CO.3: Solve first order ordinary differential equations. [L3]  
 AS101.CO.4: Analyze simple real world phenomenon governed by first order ordinary differential equations. [L4]  
 AS101.CO.5: Infer the problems based on properties of partial differentiation. [L2]  
 AS101.CO.6: Examine the applications of partial differentiation. [L4]

<b>THEORY</b>		
<b>UNIT 1</b>	<b>Matrices</b>	<b>12 HOURS</b>
Rank, Solutions of system of linear equations: Homogeneous and Non Homogeneous systems, Linear dependence and independence of vectors, Eigen Values and Eigen vectors, Cayley Hamilton Theorem		
<b>UNIT 2</b>	<b>Successive Differentiation</b>	<b>8 HOURS</b>
Finding nth derivative of functions, Leibnitz theorem for finding nth derivative, Taylors and Maclaurins theorem for expansion of functions .		
<b>UNIT 3</b>	<b>First order ordinary differential equations</b>	<b>10 HOURS</b>
Exact differential equations, Differential equations reducible to exact by finding integrating factors, linear differential equations, Differential equations reducible to linear form .		
<b>UNIT 4</b>	<b>Applications of first order ordinary differential equation</b>	<b>10 HOURS</b>
Newtons law of cooling, Electrical circuits, rectilinear motion, one dimensional heat conduction, Chemical applications- Mixing problems .		
<b>UNIT 5</b>	<b>Partial Differentiation</b>	<b>8 HOURS</b>
Partial Differentiation: Introduction, Chain rule, Total derivative and differential, Homogeneous functions, Eulers Theorem, Differentiation of Implicit functions.		
<b>UNIT 6</b>	<b>Applications of Partial Differentiation</b>	<b>8 HOURS</b>
Jacobian, properties of Jacobian, Jacobian of Implicit functions, Finding partial derivative using Jacobians, Functional dependence, maxima and minima of functions of two variables.		

<b>TUTORIAL</b>		
<b>TUTORIAL NO.01</b>		<b>1 HOURS</b>
Rank, System of Linear equations: Homogeneous and Non Homogeneous systems.		
<b>TUTORIAL NO.02</b>		<b>1 HOURS</b>
Linear Dependence and Independence of vectors, Eigen Values and Eigen vectors, Cayley Hamilton Theorem.		
<b>TUTORIAL NO.03</b>		<b>1 HOURS</b>
Finding nth derivative of functions, Leibnitz theorem for finding nth derivative.		
<b>TUTORIAL NO.04</b>		<b>1 HOURS</b>
Expansion of functions using Taylors and Maclaurins theorems.		

<b>TUTORIAL NO.05</b>		<b>1 HOURS</b>
Finding solutions to exact differential equations, Differential equations reducible to exact by finding integrating factors		
<b>TUTORIAL NO.06</b>		<b>1 HOURS</b>
Linear differential equations, Differential equations reducible to linear.		
<b>TUTORIAL NO.07</b>		<b>1 HOURS</b>
Newtons law of cooling, Kirchoffs law of electrical circuits, rectilinear motion		
<b>TUTORIAL NO.08</b>		<b>1 HOURS</b>
One dimensional heat conduction, Chemical applications Mixing Problems		
<b>TUTORIAL NO.09</b>		<b>1 HOURS</b>
Examples on Partial Differentiation and Chain rule, Total derivative and differential		
<b>TUTORIAL NO.10</b>		<b>1 HOURS</b>
Examples on Eulers Theorem, Differentiation of an implicit function		
<b>TUTORIAL NO.11</b>		<b>1 HOURS</b>
Examples on Jacobian, properties of Jacobian, Functional dependence		
<b>TUTORIAL NO.12</b>		<b>1 HOURS</b>
Examples on Functional dependence, Maxima and minima of functions of two variables		


### **TEXT BOOK**

1. Higher Engineering Mathematics by Dr. B.V. Ramana; Tata McGraw Hill, ISBN: 978-0-07-063419-2
2. Higher Engineering Mathematics by B.S. Grewal, Khanna Publications, 39th edition, ISBN: 81-7409-195-5

### **REFERENCE BOOK**

1. Thomas Calculus by G.B. Thomas, Maurice D. Weir, Joel R. Hass (ISBN:9789332519091, Pearson Education, 12th edition)
2. Advanced Engineering Mathematics by Erwin Kreyszig (ISBN-13: 9788126554232, Wiley Eastern Ltd., 10th edition)
3. Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar (ISBN No.: 8173194203, Narosa Publishing house)
4. Advanced Engineering Mathematics by Peter V. ONeil (ISBN-13: 9788131503102, Cenage Learning, 7th Edition)



 <b>MIT</b> (An Autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>			<b>COURSE SYLLABI (2016 – 2020)</b>		
	<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>			<b>W.E.F</b>	<b>AY: 2016 - 2017</b>	
<b>FIRST YEAR BACHELOR OF TECHNOLOGY</b>				<b>COURSE NAME</b>		Physics
				<b>COURSE CODE</b>		AS102
				<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/06/2016</b>				<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
3	2	40	50	10	25	NIL	125

**PRE-REQUISITE : NIL**

<b>COURSE OBJECTIVES :</b>
AS102.CEO.1: To make students identify the basic concept of measurements and to formulate problems in physical and mathematical terms.(L3).
AS102.CEO.2: To analyze and understand the behavior of light as a wave and get acquainted with different applications in Physics.(L4).
AS102.CEO.3: To apply the concept of behavior of light and understand the polarization phenomena.(L3) .
AS102.CEO.4: To classify and understand the difference of classical mechanics and quantum mechanics.(L2).
AS102.CEO.5: To derive the basic laws governing the motion of quantum particles.(L4).
AS102.CEO.6: To apply the concept of quantum mechanics to different applications and supplement the reasoning vis--vis understanding of different branches of Physics.(L3).

**COURSE OUTCOMES :**

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

AS102.CO.1: Evaluate the importance of order of all physical quantities and compare the order of size of different objects.(L5).

AS102.CO.2: Apply the theoretical knowledge of optics to understand the physics behind engineering applications.(L3).

AS102.CO.3: Apply that light is transverse in nature. (L3) .

AS102.CO.4: Demonstrate the necessity of quantum mechanics and the distinction between the domains of classical and quantum mechanics.(L2).

AS102.CO.5: Evaluate and apply the Schrdingers equation to the motion of an electron orbiting round the shell.(L5) .

AS102.CO.6: Apply the concepts of Quantum Physics in different branches of engineering.(L3)

**THEORY**

<b>UNIT 1</b>	<b>Measurement and importance of span (order) of physical quantities</b>	<b>7 HOURS</b>
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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 vernier-calipers, screw-gauge, travelling microscope and spectrometer. Span (orders of magnitude) of prominent physical parameters with specific examples of Gravitational constant(G), Speed of light(c),Planks constant(h), Boltzmann constant(k) and wavelengths of electromagnetic spectrum. Importance of the orders of G, c, h and k alongwith hypothetical picture of world in case of their order becomes unity ( 1). Length-scale and time-scale of specific physical phenomenon.

<b>UNIT 2</b>	<b>Optics (Interference and diffraction of Light)</b>	<b>7 HOURS</b>
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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, Coating of lenses as an application of thin film interference, Interference in films of uniform and non-uniform thickness (with derivation), Applications of thin-film interference, Newton Ring Experiment and its applications, Diffraction as a particular case of interference.

<b>UNIT 3</b>	<b>Polarization of Light</b>	<b>6 HOURS</b>
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Polarization of light, Production and analysis of polarized light (Brewsters law, Law of Malus), Optical Activity, Specific Rotation due to optically active solutions, Application of Polarized light.

<b>UNIT 4</b>	<b>Quantum Mechanics-I .</b>	<b>8 HOURS</b>
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Shortcomings or failure of Classical Mechanics with specific example of blackbody radiation, Plancks quantum law of blackbody radiation, Matter-waves, De-Broglies concept of matter waves, Heisenbergs Uncertainty Principle, Operators, Eigen values and Eigen functions, Expectation Values, Wave-function, Physical significance of wave function.

<b>UNIT 5</b>	<b>Quantum Mechanics-II .</b>	<b>8 HOURS</b>
Schrodingers equations, Time Dependent and Time Independent forms of Schrodinger Equations, Applications of Schrodinger Equation, Electron in an infinite potential well (rigid box), Electron in a finite deep potential well (non-rigid box) and concept of quantum mechanical tunneling, Application of electron in a potential well in case of Bohrs atomic model.		
<b>UNIT 6</b>	<b>Applications of Quantum Mechanics-LASER .</b>	<b>6 HOURS</b>
Stimulated Emission of light and its comparison with spontaneous emission, Probabilities of stimulated absorption and emission of light (Einsteins coefficients), Principle and working of LASER with example, Application of LASER in optical fibre communication.		

<b>PRACTICALS</b>		
<b>PRACTICAL NO.01</b>		<b>2 HOURS</b>
Determination of the mass of electron (me) upto specified significant numbers.		
<b>PRACTICAL NO.02</b>		<b>2 HOURS</b>
Determination of the refractive index of a given liquid using Newton Rings Experiment.		
<b>PRACTICAL NO.03</b>		<b>2 HOURS</b>
Determination of the line density of a diffraction grating using Laser.		
<b>PRACTICAL NO.04</b>		<b>2 HOURS</b>
Determination of the wavelength of Sodium light source using Michelson Interferometer.		
<b>PRACTICAL NO.05</b>		<b>2 HOURS</b>
Determination of the phase-difference between two given positions on the path of simple pendulum in periodic motion.		
<b>PRACTICAL NO.06</b>		<b>2 HOURS</b>
Verification of Bohrs atomic model using Frank and Hertz experiment.		
<b>PRACTICAL NO.07</b>		<b>2 HOURS</b>
Determination of the specific rotation of a sugar solution of a given concentration.		
<b>PRACTICAL NO.08</b>		<b>2 HOURS</b>
Determination of wavelength of a laser beam using Lloyds mirror arrangement.		


<b>PRACTICAL NO.09</b>		<b>2 HOURS</b>
Determination of Radius of Curvature of a given planoconvex lens using Newtons Rings apparatus.		
<b>PRACTICAL NO.10</b>		<b>2 HOURS</b>
Determination of wavelength of different colours present in a white light.		

### TEXT BOOK

1. The Feynman Lectures on Physics: Volume-1-Richard. P. Feynman, R.B. Leighton, M.Sands,ISBN:978-81-85015-82-8.(Narosa Publisher)
2. The Feynman Lectures on Physics: Volume-3-Richard. P. Feynman, R.B. Leighton, M.Sands,ISBN:978-81-85015-84-2. (Narosa Publisher)

### REFERENCE BOOK

1. Measurement and Instrumentation Principles: Alan S Morris, Butterworth Heinemann, ISBN 07506508184
2. AjoyGhatak ,Optics, Tata Mc Graw Hill Publishing Company. Ltd., 2nd Edition, ISBN- 0-07058583-0
3. Jenkins White, Fundamentals of Optics, Mc Graw Hill Science, ISBN-0070853460.
4. Arthur Beiser, Shobit Mahajan, S. Rai. Choudhary ,Concepts of Modern Physics-, Mc Graw Hill Education (India) Pvt. Ltd., 6th Edition, ISBN-10- 0070151555,
5. L. I. Schiff ,Quantum Mechanics, Tata Mc Graw Hill Education (India) Pvt. Ltd., 3rd Edition, ISBN-10- 0070856435, ISBN- 13- 9780070856431.
6. PAM Dirac,Principles of Quantum Mechanics Cbs publishers and Distributors, ISBN-10- 0195671074, ISBN- 13- 978019567107
7. D J Griffiths, Introduction to Quantum Mechanics, Pearson Prentice Hall Publishers.
8. Serway and Jewett, University Physics for Scientists and Engineers, Cengage Learning Publishers.
9. K. Thyagarajan and AjoyGhatak, Lasers: Fundamentals and applications, Springer, ISBN 9781441964410.
10. Worsnop and Flint; Advanced Practical Physics, Little Hampton book service Ltd., ISBN-10: 0423738909, ISBN-13: 978-0423738902.
11. Robert Eisberg and Robert Resnick; Quantum Mechanics: Of Atoms, Molecules, Solids, Nuclei and Particles; Wiley

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	<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>			<b>W.E.F</b>	<b>AY: 2016 - 2017</b>
<b>FIRST YEAR BACHELOR OF TECHNOLOGY</b>			<b>COURSE NAME</b>		Chemistry
			<b>COURSE CODE</b>		AS103
			<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/06/2016</b>			<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
3	2	40	50	10	25	NIL	125

**PRE-REQUISITE :** Basic Chemistry of XI and XII

<b>COURSE OBJECTIVES :</b>
AS103.CEO.1: To summarize the basic chemistry and classic methods of analysis, which includes solution, concentrations and indicators.
AS103.CEO.2: To outline the technology involved in improving quality of water for its industrial use.
AS103.CEO.3: To illustrate the basic concepts of analytical techniques that facilitates rapid and reliable measurements.
AS103.CEO.4: To demonstrate the use of ultra violet visible spectroscopy as invaluable tools in synthetic chemistry.
AS103.CEO.5: To list and explain the principle & techniques of separation methods.
AS103.CEO.6: To define the basic aspects of advanced materials & their applications.

**COURSE OUTCOMES :**

On successful completion of the course the student will be able to

AS103.CO.1: Relate classic methods of analysis by preparing solutions of desired concentrations & carrying out quantitative analysis by volumetric methods. (L1)

AS103.CO.2: :Identify different methodologies for water quality analysis for industrial application. (L3)

AS103.CO.3: Apply basic concepts of electro-analytical techniques for analysis of various chemical compounds and solutions. (L3)

AS103.CO.4: Extend the knowledge of calculating wavelength of absorption of various chemical compounds using UV-Visible spectroscopy. (L2)

AS103.CO.5: Outline the different methods for separation of mixtures of various chemical compounds.(L2)

AS103.CO.6: Categorize the different engineering materials and to solve engineering problems.(L4)

**THEORY****UNIT 1 | Instrumental volumetric analysis****7 HOURS**

Introduction, methods of expressing concentrations (Self-study), primary and secondary standard solutions. Instrumental & non instrumental analysis principles & types; Types of Titrations based on reaction, AcidBase titrations: Indicatorstheory of indicators, acid base indicators, mixed and universal indicators; Titration curve for Strong acidStrong base type, Introduction to Weak acidStrong base, Strong acid-Weak base titration, Precipitation titration, Applications in quantitative analysis.

**UNIT 2 | Water treatment and effluent management****7 HOURS**

Introduction to conventional water treatment: Complexometric titrations: Principle, EDTA titrations, choice of indicators, Hardness of water & Alkalinity of water, causes, types, numerical, internal methods of water softening, Advanced wastewater & water Treatment: i) filtration method: Carbon adsorption ii) ion-exchange method iii) membrane techniques: reverse osmosis and electro-dialysis & their applications in water purification.

**UNIT 3 | Electroanalytical Techniques****7 HOURS**

Introduction to electrodes, pH metry: Standardization of pH meter, titration curve for the mixture of acids Vs strong base, differential plots, Conductometry: Introduction, Kohlrauschs law, measurement of conductance, Application of conductometer in Acid-Base titrations & Precipitation titrations. Potentiometry: Introduction, application in redox titrations example of Fe/Ce titration.

<b>UNIT 4</b>	<b>Ultra Violet Spectroscopy</b>	<b>7 HOURS</b>
Introduction, nature of UV, Beers law, absorption of UV radiation by organic molecule leading to different excitation, Terms used in UV Spectroscopy- Chromophore, Auxochrome, Bathochromic shift(Red shift), hypsochromic shift(Blue shift), hyperchromic and hypochromic effect. Instrumentation, Effect of conjugation on position of UV band. Calculation of max by Woodward and Fisher rules for dienes and enone systems, Applications of UV Spectroscopy- Determination of structure, Determination of stereo chemistry (Cis and trans)		
<b>UNIT 5</b>	<b>: Chromatography</b>	<b>6 HOURS</b>
Introduction and classification of chromatographic methods, Theory, Principle, technique and applications of-Column Chromatography, Thin layer Chromatography, Paper Chromatography, Gas Chromatography. Applications of chromatographic techniques		
<b>UNIT 6</b>	<b>: Engineering Materials.</b>	<b>8 HOURS</b>
Introduction to Material Sciences, Polymers: Introduction, Specialty polymers, Applications in electronic gadgets, housing & construction, automobiles etc. Biomaterials: Introduction, characteristics, examples, challenges, Carbon nano materials: Introduction, types & applications. Smart materials: Introduction, types, examples like piezo materials, shape memory, thermo responsive etc..		

<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>		<b>2 HOURS</b>
Preparation and Standardization of solutions		
<b>PRACTICAL NO.02</b>		<b>2 HOURS</b>
Estimation of ions from given solution by Redox titration		
<b>PRACTICAL NO.03</b>		<b>2 HOURS</b>
Determination of the total hardness of a given water sample by EDTA method		
<b>PRACTICAL NO.04</b>		<b>2 HOURS</b>
Adsorption: Removal of organic dyes by activated charcoal		
<b>PRACTICAL NO.05</b>		<b>2 HOURS</b>
Determination of the dissociation constant of a weak acid using pH meter		
<b>PRACTICAL NO.06</b>		<b>2 HOURS</b>
Conduct metric titrations		
<b>PRACTICAL NO.07</b>		<b>2 HOURS</b>
Verification of Beers law & colorimetric estimation		

<b>PRACTICAL NO.08</b>		<b>2 HOURS</b>
Determination of max of organic/ inorganic compound using UV-visible spectrophotometer		
<b>PRACTICAL NO.09</b>		<b>2 HOURS</b>
Separation of mixture of two organic compounds by Thin Layer Chromatography		
<b>PRACTICAL NO.10</b>		<b>2 HOURS</b>
Separation of two cations by paper chromatography		
<b>PRACTICAL NO.11</b>		<b>2 HOURS</b>
Separation & purification of chemical compounds by Gas chromatography		


### **TEXT BOOK**

1. Jain & Jain, Engineering Chemistry, 15th Edition, Dhanpat Rai Publications company
2. S.M. Khopkar , Basic Concept of Analytical Chemistry, 2nd edition, New Age Science Ltd ISBN-10: 1906574006 ISBN-13: 978- 1906574000
3. Dr. B. S. Chauhan , Engineering Chemistry, 3rd Edition, Laxmi Publications Pvt. Ltd.

### **REFERENCE BOOK**

1. V.M.Parikh , Absorption Spectroscopy of Organic Molecules, Addison Wesley Longman Publishing Co, ISBN 10: 0201057085, ISBN 13: 9780201057089.
2. Skoog, Fundamentals of Analytical Chemistry, Cengage Learning, ISBN-13: 978-0495558286, ISBN-10: 0495558281
3. Willard, Merritt, Dean and Settle, Instrumental Methods of chemical analysis, 6th edition, Wadsworth Publishing Co. ISBN-10: 0534081428, ISBN-13: 978-0534081423.
4. Donald R. Askeland, Pradeep Fulay, W. J. Wright, The Science & Engineering of Materials, 6th Edition, Cengage Learning, 2010
5. O. P. Virmani & A. K. Narula , Applied Chemistry: Theory and Practice , New Age International Pvt. Ltd. Publishers, ISBN-10: 8122408141, ISBN-13: 978-8122408140



 <b>Academy of Engineering</b> (An Autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2016 - 2017</b>
<b>FIRST YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>	Electrical & Electronics Engineering
		<b>COURSE CODE</b>	EX101
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2016</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	40	50	10	25	Nil	125

**PRE-REQUISITE :**

**COURSE OBJECTIVES :**

EX101.CEO.1: To impart knowledge of energy scenario and use of renewable energy systems.  
 EX101.CEO.2: To explain the fundamentals of single-phase and three-phase systems.  
 EX101.CEO.3: To explain power supply components, electronic devices.  
 EX101.CEO.4: To summarize various Digital systems and application.  
 EX101.CEO.5: To build the knowledge of measuring system and signal conditioning circuits.  
 EX101.CEO.6: To get acquainted with different electrical machines.

**COURSE OUTCOMES :**

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

EX101.CO.1: Develop the Renewable energy system (PV) as per given specifications [L3]  
 EX101.CO.2: Illustrate behavior of single phase A.C. circuits and three phase A.C. circuits. [L2]  
 EX101.CO.3: Analyze analog circuit applications.[L3]  
 EX101.CO.4: Design Digital applications.[L5]  
 EX101.CO.5: the use of Instrumentation system in various fields.[L2]  
 EX101.CO.6: Identify electrical machines used in typical domestic and industrial sector based on application. [L2]

<b>THEORY</b>		
<b>UNIT 1</b>	<b>Energy Resources &amp; Technology</b>	<b>6 HOURS</b>
Energy Scenario, Energy Resources, Basic concepts about thermal, hydro and nuclear power stations (block diagram approach only). Energy conversion from thermal and mechanical energy, Energy Conservation, Use of Energy Efficient Technologies, Application of Renewable Energy Systems, Battery technology, Introduction to power quality: Definition, causes, effects, Introduction to energy audit.		
<b>UNIT 2</b>	<b>A.C. Circuits</b>	<b>7 HOURS</b>
A.C. fundamentals, RMS and average value, R-L,R-C,RLC series parallel circuits, phasor diagram, power and power factor. Three phase voltage generation and their waveforms, Star and delta balanced systems, Relationship between phase and line quantities, phasor diagram, power in a three phase circuits, Difference between neutral and ground conductors.		
<b>UNIT 3</b>	<b>Power Supply and Electronics Devices</b>	<b>7 HOURS</b>
Rectifiers and Power Supplies, Elements of IC Regulated Power Supply. BJT - structure and operation, CE, CB, CC configurations, Transistor as a switch and Amplifier. MOSFET- structure (enhancement), operation and application as a switch. Opto-electronic devices Photo conductive cell, Photo Voltaic cell.		
<b>UNIT 4</b>	<b>Digital Systems</b>	<b>7 HOURS</b>
Digital: Logic gates, Boolean algebra, SOP representation, Combinational circuit Design: Half Adder, Full Adder, MUX, DMUX, Comparator, Code converter, Decoder Sequential circuit: Flip-Flop, Registers and Synchronous & Asynchronous Counters. Microprocessor based systems, Embedded systems		
<b>UNIT 5</b>	<b>Measuring System</b>	<b>6 HOURS</b>
Elements of measuring system, Sensors & Transducers Temperature, Flow, Pressure, IR, Speed & LVDT. Op-Amp IC 741 pin configuration, Op-amp parameters, Inverting, Non- Inverting & Differential configuration Applications: Summing & Difference amplifier, Comparator, Voltage follower.		
<b>UNIT 6</b>	<b>Electrical Machines</b>	<b>7 HOURS</b>
Construction of Transformer, principle of operation, EMF equation. Construction, principle of operation and types of three-phase Induction motor and DC motor, PMDC, BLDC, servo motor, stepper motor, Universal motor, Application of Electrical Motors in domestic and Industrial sector.		

<b>PRACTICALS : Total 8 Experiments from two groups.</b>		
<b>PRACTICAL NO.01</b>	<b>Kirchhoffs laws and Superposition theorem</b>	<b>2 HOURS</b>
To develop a circuit for Kirchhoffs laws and Superposition theorem. To build and test it.		
<b>PRACTICAL NO.02</b>	<b>Single Phase Energy (Watt-hour) measurement.</b>	<b>2 HOURS</b>
To measure energy and power factor. To examine improvement in the power factor. To estimate and compare energy consumption with energy meter.		
<b>PRACTICAL NO.03</b>	<b>R-L-C series A.C. circuit</b>	<b>2 HOURS</b>
To calculate exact values of R, L and C for lagging and leading power factor To find power losses in R, L and C.		
<b>PRACTICAL NO.04</b>	<b>Verification of relation between Line and Phase quantities in Star and Delta circuits</b>	<b>2 HOURS</b>
To understand Line & Phase quantities and types of connection along with Three phase supply To connect Bulb load in Star connection and verify the relation. To connect Bulb load in Delta connection and verify the relation.		
<b>PRACTICAL NO.05</b>	<b>Open circuit &amp; Short circuit test on a Single Phase transformer</b>	<b>2 HOURS</b>
To find iron loss and no load current To find full load copper loss and winding parameters To determine efficiency and regulation of transformer		
<b>PRACTICAL NO.06</b>	<b>Load test on D.C. Shunt Motor.</b>	<b>2 HOURS</b>
To find the torque and output power of motor To calculate the efficiency of motor.		
<b>PRACTICAL NO.07</b>	<b>Step angle control of Stepper motor.</b>	<b>2 HOURS</b>
To gain familiarity with the properties of stepper motors. To calculate the step angle of motor.		
<b>PRACTICAL NO.08</b>	<b>Speed control of BLDC/PMDC Motor.</b>	<b>2 HOURS</b>
To find the relation between voltage and speed of motor To develop any small application.		
<b>PRACTICAL NO.09</b>	<b>Electronics Components and Measuring instruments:</b>	<b>2 HOURS</b>
To study Passive components Resistors, Capacitors & Inductor. To test semiconducting components Diode, BJT To measure various electronic quantities using CRO, Function generator, DMM		
<b>PRACTICAL NO.10</b>	<b>DC Regulated Power Supply:</b>	<b>2 HOURS</b>
To design 12V IC based DC regulated power supply (Theoretically). To test and observe waveforms at various stages on CRO and measure the voltage using DMM.		
<b>PRACTICAL NO.11</b>	<b>BJT as a switch and Amplifier.</b>	<b>2 HOURS</b>
To adapt BJT as a switch On/Off the LED at the output by switching BJT. To adapt BJT as an Amplifier Measure voltages and observe waveforms at input and output of the single stage CE amplifier.		


<b>PRACTICAL NO.12</b>	<b>Combinational Digital Circuits:</b>	<b>2 HOURS</b>
To design and implement Half adder and Full adder (using Half adder). To design and implement 8:1 MUX using IC-74LS153 and verify its truth table.		
<b>PRACTICAL NO.13</b>	<b>Sequential Digital Circuits:</b>	<b>2 HOURS</b>
To design and implement Half adder and Full adder (using Half adder). To design and implement 8:1 MUX using IC-74LS153 and verify its truth table.		
<b>PRACTICAL NO.14</b>	<b>OP-AMP Applications</b>	<b>2 HOURS</b>
To verify operations of inverting and non-inverting amplifier for various gain factors. To verify application of OPAMP as summing and difference amplifier. To verify the application of OPAMP as voltage follower.		
<b>PRACTICAL NO.15</b>	<b>Sensors and Transducer</b>	<b>2 HOURS</b>
To study and verify operation of LVDT. To study and verify the operation of Temperature sensors. (PT100, LM35)		
<b>PRACTICAL NO.16</b>	<b>Design and Simulate using MULTISIM(Minimum 2)</b>	<b>2 HOURS</b>
To design a counter to display 2-digit Decimal Number (00 to 99) on 7-Segment Display. To design a Flashing LED Display for a specific Pattern using MUX. To design of Inverting/Non-Inverting Amplifier using Op-Amp IC-741 for a specific gain.		

### **TEXT BOOK**

1. B. H. Khan, Non-Conventional Energy Resources, Tata McGraw Hill, 2nd Edition, 2009, 978-0070142763.
2. Edward Hughes, Electrical and Electronic Technology Pearson India, 10th Edition, 2011, ISBN-978-8131733660
3. Neil Storey, Electronics A Systems Approach, Pearson Education Asia, 5th Edition, 2013, ISBN-978-0273773276

### **REFERENCE BOOK**

1. V. N. Mittle and ArvindMittal, Basic Electrical Engineering, McGraw Hill Education, 2nd Edition, 2005, ISBN- 978-0070593572.
2. D. P. Kothari, I. J. Nagrath, Electric Machines, McGraw Hill, 4th Edition, 2010, 978-0070699670.
3. Thomas L. Floyd, Electronics Devices & Circuits, Pearson Education India, 5th Edition, 1998, 978-0136491385.
4. Paul Horowitz, Winfield Hill, The Art of Electronics, Cambridge University press, 3rd Edition, 978-0521809269.

 <b>MIT</b> (An Autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>			<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>			<b>W.E.F</b>	<b>AY: 2016 - 2017</b>
<b>FIRST YEAR BACHELOR OF TECHNOLOGY</b>			<b>COURSE NAME</b>		Applied Mechanics
			<b>COURSE CODE</b>		CV101
			<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/06/2016</b>			<b>REVISION NO</b>		0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	40	50	10	25	Nil	125

**PRE-REQUISITE :** Physics and Mathematics of XI & XII

**COURSE OBJECTIVES :**

CV101.CEO.1: To classify force systems and explain the conditions of equilibrium.  
 CV101.CEO.2: To illustrate laws of friction.  
 CV101.CEO.3: To demonstrate the concepts of centroid and moment of inertia.  
 CV101.CEO.4: To describe kinematic parameters of motion.  
 CV101.CEO.5: To make use of laws of motion for kinetics.  
 CV101.CEO.6: To explain energy and momentum methods.

**COURSE OUTCOMES :**

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

CV101.CO.1: Determine the resultant and support reactions.(L5)  
 CV101.CO.2: Analyze bodies involving frictional forces. (L4)  
 CV101.CO.3: Evaluate centroids of bodies and moment of inertia of sections. (L5)  
 CV101.CO.4: Identify the type of motion and its kinematic parameters. (L3)  
 CV101.CO.5: Analyze the motion under action of constant and variable forces. (L4)  
 CV101.CO.6: Apply energy and momentum methods for kinetics. (L3)

<b>THEORY</b>		
<b>UNIT 1</b>	<b>Fundamentals of statics</b>	<b>8 HOURS</b>
Basic concepts and fundamental principles, force, moment of a force, couple, resolution and composition of forces, Free body diagrams, equations of equilibrium, equilibrium of coplanar and non-coplanar force system, applications to jib crane, beams, and cables.		
<b>UNIT 2</b>	<b>Friction</b>	<b>6 HOURS</b>
Introduction, types of friction, laws of friction, angle of friction, angle of repose, cone of friction, engineering applications - blocks and wedges, ladder friction, screw jack, pulley and belt drives, band brakes.		
<b>UNIT 3</b>	<b>Properties of surfaces</b>	<b>6 HOURS</b>
Concept of Centroid and centre of gravity, centroids of composite 1D and 2D objects. Introduction to moment of inertia, radius of gyration, parallel axes theorem, perpendicular axis theorem, MI of composite objects. Distributed loading, fluid pressure-application to dams and gates.		
<b>UNIT 4</b>	<b>Kinematics</b>	<b>8 HOURS</b>
Basic concepts in kinematics, Motion with uniform and variable acceleration, Motion curves, Curvilinear Motion in Rectangular coordinates, path coordinates, polar coordinates. Kinematic Link and Kinematic Pair, Kinematic Chain, Mechanisms and its inversions, instantaneous centre of rotation, Kennedy's Theorem, Applications- slider and crank mechanism, Railway engine and its supporting flywheel motions, Linkage mechanism of excavator and its system.		
<b>UNIT 5</b>	<b>Kinetics</b>	<b>6 HOURS</b>
Kinetics of rectilinear and circular motion of a particle acted upon by a constant and variable force system, Newtons second laws of Motion, Equations of motion, concept of dynamic equilibrium, and motion of connected bodies. Basic principles of vehicle dynamics, Forces acting on a vehicle, tire mechanics, Dynamics of linear and lateral motion.		
<b>UNIT 6</b>	<b>Energy and Momentum</b>	<b>8 HOURS</b>
Work, power and energy, Principles of work and Energy, Motion under a Conservative Central Force. Application to Space Mechanics. Impulse, momentum, Principle of Impulse and Momentum, Collisions-elastic and plastic, Direct central impact, coefficients of restitution. Applications-vehicle collisions, sports viz. cricket, tennis, billiard.		

<b>PRACTICALS</b>		
<b>PRACTICAL NO.01</b>	<b>Group 1] Basic principles/laws</b>	<b>2 HOURS</b>
1. To verify triangle law/ Lami's theorem 2. To verify polygon law of forces. 3. To verify law of moments. 4. To verify equilibrium of parallel forces. (Beam Reactions) 5. To verify equilibrium of concurrent forces in space.		
<b>PRACTICAL NO.02</b>	<b>Group 2] Friction</b>	<b>2 HOURS</b>
1.To verify laws of friction. 2. To determine angle of repose for a given block and surface. 3. To determine static coefficient of friction for a block on horizontal plane. 4. To determine static coefficient of friction for a block on inclined plane. 5. To determine static coefficient of friction for flat belt and drum.		
<b>PRACTICAL NO.03</b>	<b>Group 3] Centroid/centre of gravity</b>	<b>2 HOURS</b>
1. To determine centroid of irregular triangular lamina. 2. To determine centroid of polygonal lamina. 3. To determine centre of gravity of a wire bend. 4. To determine centroid of a composite lamina. 5. To find the shift of centroid after cutting some part of lamina.		
<b>PRACTICAL NO.04</b>	<b>Group 4] Motion(Dynamics)</b>	<b>2 HOURS</b>
1. To study curvilinear motion of a particle. 2. To verify value of g using compound pendulum. 3. To determine coefficient of restitution. 4. To determine mass moment of inertia of a fly wheel. 5. To verify law of conservation of momentum.		
<b>PRACTICAL NO.05</b>	<b>Group 5] Graphical Exercises</b>	<b>2 HOURS</b>
1. To determine resultant of concurrent forces. 2. To determine resultant of parallel/general forces. 3. To determine reactions for a simple beam. 4. To draw motion curves for given kinematics problem. 5. To determine relative velocity by graphical method. Part B] Students will have to complete a task/activity after each practical which will be based on the theme of that group. (10 Hrs)		

**TEXT BOOK**

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1. A. Nelson "Engineering Mechanics: Statics and Dynamics", Tata McGraw-Hill Education, ISBN: 978-0-07-014614-3
2. R.C Hibbeler "Engineering Mechanics", Pearson Education, ISBN: 978-0136077909

**REFERENCE BOOK**

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1. F. P. Beer and E. R. Johnston "Vector Mechanics for Engineers Vol.I and II", Tata Mc-Graw, ISBN: 978-0077402327
2. Ferdinand Singer, Harper and Row "Engineering Mechanics Statics and Dynamics", ISBN:0063506610
3. Manoj K Harbola "Engineering Mechanics", Cengage Learning, ISBN:8131509907



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<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2016 - 2017</b>
<b>FIRST YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>	Engineering Graphics
		<b>COURSE CODE</b>	ME101
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2016</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
2	4	40	50	10	50	Nil	150

**PRE-REQUISITE :**

**COURSE OBJECTIVES :**

ME101.CEO.1: To impart knowledge about principles/methods related to projections of one, two and three-dimensional objects.

ME101.CEO.2: To develop & apply visualization skill to simple Objects.

ME101.CEO.3: To expose students to computer aided drafting tools.

**COURSE OUTCOMES :**

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

ME101.CO.1: Recall fundamentals of projections (L1)

ME101.CO.2: Interpret engineering drawings (L2)

ME101.CO.3: Apply visualization skill to draw various views of object (L3)

ME101.CO.4: Analyze engineering drawings (L4)

ME101.CO.5: Decide annotations for two dimensional drawings (L5)

ME101.CO.6: Develop and/or comprehend a simple engineering drawing in both First and Third angle orthographic projections(L4)


<b>THEORY</b>		
<b>UNIT 1</b>	<b>Visual Thinking &amp; Solid Geometry</b>	<b>5 HOURS</b>
Essentials of engineering graphics including technical sketching, Projection of Line, Plane, Solid.		
<b>UNIT 2</b>	<b>Orthographic Projections &amp; Sectional Views</b>	<b>5 HOURS</b>
Reference Planes, Types of Orthographic Projections, Sectional Orthographic Projections, Sectional Views.		
<b>UNIT 3</b>	<b>Isometric Projections</b>	<b>5 HOURS</b>
Isometric View, Isometric Scale, Non-isometric Lines, construction of Isometric View from the given orthographic view and construction of isometric View of Pyramid, Cone, Sphere.		
<b>UNIT 4</b>	<b>Interpretation of given view/ missing view</b>	<b>5 HOURS</b>
Identification of lines/ edges and surfaces, visualization of given orthographic views, adding missing/ third view, adding a sectional view, to convert a given view into sectional view.		
<b>UNIT 5</b>	<b>Auxiliary Projections</b>	<b>4 HOURS</b>
Auxiliary Planes- Auxiliary Vertical Plane, Auxiliary Inclined Plane, Symmetrical Auxiliary View, Unilateral Auxiliary View, bilateral Auxiliary View.		
<b>UNIT 6</b>	<b>Freehand Sketching &amp; Technical Drawing</b>	<b>4 HOURS</b>
Free hand sketching- FV & TV of standard machine part- Hexagonal headed nut and bolt, foundation bolts, shafts, keys, couplings, springs, screw thread forms, welded joints, riveted joints, nozzles.		

<b>PRACTICALS : Each Assignment contains 2 questions.</b>		
<b>PRACTICAL NO.01</b>		<b>10 HOURS</b>
Projection of Lines, Plane, Solids		
<b>PRACTICAL NO.02</b>		<b>8 HOURS</b>
Orthographic Projections, Missing Views		
<b>PRACTICAL NO.03</b>		<b>6 HOURS</b>
Isometric Projections		
<b>PRACTICAL NO.04</b>		<b>4 HOURS</b>
Auxiliary View		

<b>PRACTICALS : Assignments to be drawn on modeling software package.</b>		
<b>PRACTICAL NO.05</b>		<b>4 HOURS</b>
Absolute and Incremental drawing.		
<b>PRACTICAL NO.06</b>		<b>6 HOURS</b>
Draw commands, Modify commands, Array, fillet, offset commands		
<b>PRACTICAL NO.07</b>		<b>2 HOURS</b>
Project drafting		
<b>PRACTICAL NO.08</b>		<b>12 HOURS</b>
Sketching, Solid Modeling, Assembly		
<b>PRACTICAL NO.09</b>		<b>4 HOURS</b>
Project modeling		

<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. Dhanajay A. Jolhe, Engineering Drawing with an introduction to Auto CAD, TMH Publishing co Ltd, 5th Edition, 2012, (ISBN 13: 9780070648371)</li> <li>2. Basant Agarwal and C M Agarwal, Engineering Drawing, TMH Publishing co Ltd, 2nd Edition 2013, (ISBN13: 978-1-259-06288-9)</li> <li>3. K C John, Engineering Graphics for Degree, PHI learning pvt. Ltd. New Delhi,2009, (ISBN: 97881-203-3788-6)</li> <li>4. R. K. Dhavan, A Text Book of Engineering Drawing, S Chand and co ltd., New Delhi India, 5Th Edition, 2012, ISBN 13: 9788121914314</li> </ol>

<b>REFERENCE BOOK</b>
<ol style="list-style-type: none"> <li>1. Luzadder, Warren J., Duff, John M, Fundamentals of Engineering, Prentice Hall of India,11th Edition, 2010, (ISBN: 978-81-203-0885-5)</li> <li>2. Basudev Bhattacharya, Machine Drawing includes Autocad Supplements, Oxford University Press India, First Edition, 2011, (ISBN 13: 9780198070771)</li> <li>3. K. Venugopal, Prabhu Raja V., Engineering Drawing and Graphics, New age Publications, First Edition, 2008, (ISBN: 978-81-224-2457-7)</li> <li>4. N B Shaha and B C Rana, Engineering Drawing, Pearson Education, 2012, (ISBN: 9788131798058)</li> </ol>

 <b>Academy of Engineering</b> (An Autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2016 - 2017</b>
<b>FIRST YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>	Computer Programming
		<b>COURSE CODE</b>	IT101
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2016</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
2	4	40	50	10	25	NIL	125

**PRE-REQUISITE :** Knowledge of computer system.

**COURSE OBJECTIVES :**

IT101.CEO.1: To define and summarize the basic terminologies used in computer programming.

IT101.CEO.2: To develop and demonstrate logic for a given problem using algorithms and Flowcharts.

IT101.CEO.3: To evaluate solutions for the given problem using problem solving tools.

IT101.CEO.4: To identify and analyze different control structures.

IT101.CEO.5: To understand and use of simple data structures using Python.

IT101.CEO.6: To demonstrate and understand different computer applications in engineering.

**COURSE OUTCOMES :**

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

IT101.CO.1: Analyze a problem and identify and define the computing requirements appropriate to its solution [L3][L4].

IT101.CO.2: Apply the knowledge and strategies for structuring code, dividing problems up into pieces that can be solved independently, then integrating the pieces into a whole to solve a large problem [L3].

IT101.CO.3: Analyze when to select the different types of data structures such as arrays and lists as a framework for solving a problem [L4].

IT101.CO.4: Design, correctly implement and document solutions to problems using Python [L6].

IT101.CO.5: Analyze and compare alternative solutions to computing problems [L2][L4]

IT101.CO.6: Adapt to new developments in the field of computer science [L6].

<b>THEORY</b>		
<b>UNIT 1</b>	<b>Problem Solving Concepts</b>	<b>6 HOURS</b>
General Problem Solving Concepts-types of problems, problem solving with computers, difficulties with problem solving, Problem solving concepts for the computer: Constants, Variables, Data types, operators, Expressions, Equations, Problem solving tools. Programming structure-Modules and their functions, Cohesion and Coupling, Local and Global Variables, Parameters, return values		
<b>UNIT 2</b>	<b>Problem solving and Logic structure</b>	<b>8 HOURS</b>
Logic structures, Problem solving with sequential logic structure - The sequential logic structure, solution development. Problem Solving with Decisions decision logic structure, multiple Decision instructions, straight-through logic, positive logic, negative logic, logic conversion, Problem solving with loops and case logic structures.		
<b>UNIT 3</b>	<b>Arrays, Strings and File Processing</b>	<b>8 HOURS</b>
One dimensional, multidimensional array, finding maximum number in a set, Partitioning of array, finding smallest element, searching an array for a range. String Handling Operations: Concatenation, Copy, Substring, Compare, Length, Case Change, and Reverse. File handling and file handling operations, File Handling Modes.		
<b>UNIT 4</b>	<b>Programming Applications</b>	<b>6 HOURS</b>
Programming applications, Predictive analysis with examples, Graphics and animation, working with matrices, Graphics & Visualization, Differential Equation: Linear Differential Equations, Digital Signal Processing: Plotting different waveforms.		

<b>PRACTICALS</b>		
<b>PRACTICAL NO.01</b>		<b>6 HOURS</b>
<ol style="list-style-type: none"> <li>1. Find the result of all the arithmetic operations (Addition, Subtraction, Multiply, Division and modulo) in Python.</li> <li>2. Show the distance in miles per gallon with respect user defined value in Python.</li> <li>3. Find the kinetic energy of an object.</li> </ol>		
<b>PRACTICAL NO.02</b>		<b>6 HOURS</b>
<ol style="list-style-type: none"> <li>1. Write a Python program for printing result of five subjects for five students.</li> <li>2. Choose any value and find whether the number is even or odd.</li> <li>3. Identify whether the number entered by user is prime or not.</li> </ol>		


<b>PRACTICAL NO.03</b>		<b>6 HOURS</b>
<ol style="list-style-type: none"> <li>1. Solve the Fibonacci sequence using recursive function in Python.</li> <li>2. Illustrate factorial of non-negative numbers in Python.</li> <li>3. Build asterisk (*) graph in Python</li> </ol>		
<b>PRACTICAL NO.04</b>		<b>6 HOURS</b>
Electric circuits, Chemical applications- Mixing problems.		
<b>PRACTICAL NO.05</b>		<b>6 HOURS</b>
<ol style="list-style-type: none"> <li>1. Select the number from the entered list and find its position in Python (use Linear Search).</li> <li>2. Select the number and find its position of in Python (use Binary search).</li> <li>3. Choose cricket team of eleven players find the captain of the team (consider tallest person as a captain)</li> </ol>		
<b>PRACTICAL NO.06</b>		<b>6 HOURS</b>
<ol style="list-style-type: none"> <li>1. Select a text file and count number of words, repeated words in a file.</li> <li>2. Choose the words from the file, store in the list and sort the list is ascending order.</li> <li>3. Create duplicate the file from an original file.</li> </ol>		
<b>PRACTICAL NO.07</b>		<b>6 HOURS</b>
<ol style="list-style-type: none"> <li>1. Predict whether the entered string is palindrome or not.</li> <li>2. Compare two strings and convert in opposite case in Python.</li> <li>3. Select any two words and perform concatenation operation</li> </ol>		
<b>PRACTICAL NO.08</b>		<b>14 HOURS</b>
<ol style="list-style-type: none"> <li>1. Create a simple picture in python using graphics package.</li> <li>2. Construct 2D and 3D plotting the Objects.</li> <li>3. Create Sine waveform, Cosine waveform, Square waveform, Saw-tooth waveform, using MATLAB and discrete the same.</li> <li>4. Solve the matrix operations (Addition, Multiplication, and Transverse) in MATLAB.</li> <li>5. Design an application to display student result using predictive analysis</li> </ol>		

<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. 1. Problem Solving and Programming Concepts ,Maureen Sprankle , Pearson Publication, Seventh Edition, ISBN 81-317-0711-3.</li> <li>2. How to think like a Computer Scientist, Learning with Python Allen Downey, Jeffrey Elkner, Chris Meyers, Green Tea Press ISBN: 0-9716775-0-6.</li> </ol>

## REFERENCE BOOK

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1. Learning Python Mark Lutz Oreilly Publication 5th Edition ISBN-13: 978-1449355739.
2. A MATLAB Exercise Book LudmilaKuncheva, Cameron Gray, Perfect-bound Paperback, ISBN 9781291784794.
3. How to solve it by Computer, R.G.Dromey, First Edition, Pearson Publication, ISBN 978-81-315-0562-9.
4. Introduction To Computation And Programming Using Python "Guttag John V, PHI(2014), ISBN-13 : 978-8120348660.

 <b>Academy of Engineering</b> (An Autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2016 - 2017</b>
<b>FIRST YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>	Language and Communication 1
		<b>COURSE CODE</b>	HP101
		<b>COURSE CREDITS</b>	2
<b>RELEASED DATE : 01/06/2016</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
1	2	30	35	10	25	Nil	100

**PRE-REQUISITE:** Basic proficiency in English at the higher secondary school level

**COURSE OBJECTIVES:**

HP101.CEO.1: To introduce a variety of English texts to the students.  
 HP101.CEO.2: To teach basic English grammar.  
 HP101.CEO.3: To guide the students to write in English coherently and formally.  
 HP101.CEO.4: To improve the students overall communicative competence in English through activities like group discussions and debates.

**COURSE OUTCOMES:**

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

HP101.CO.1: Interpret texts written in English. [L2, L5]  
 HP101.CO.2: Apply English grammar rules correctly. [L3]  
 HP101.CO.3: Develop sentences and texts in English coherently and formally. [L3, L6]  
 HP101.CO.4: Demonstrate overall improvement in communication skills. [L 2]




<b>THEORY</b>		
<b>UNIT 1</b>	<b>Functional Grammar</b>	<b>4 HOURS</b>
Use of tenses in day to day communication and academic writing, Direct and Indirect Speeches, Active and Passive voices, Degrees of comparison, Use of the parts of speech in sentence composition, Verb forms and Modal auxiliaries		
<b>UNIT 2</b>	<b>Communication</b>	<b>8 HOURS</b>
Concept of communication, Types-verbal and non-verbal, principles of effective communication, barriers to communication, cross-cultural communication		
<b>UNIT 3</b>	<b>Academic Writing</b>	<b>6 HOURS</b>
Essentials of good writing, Review writing, Letter writing, Report writing, Prcis writing, and Essay writing		

<b>PRACTICALS</b>		
<b>PRACTICAL NO.01</b>	<b>Common Errors in Communicative English</b>	<b>6 HOURS</b>
A task of identifying and correcting the common errors in general as well as academic English by using audios and relevant academic texts; tips on punctuation.		
<b>PRACTICAL NO.02</b>	<b>Debate</b>	<b>4 HOURS</b>
Concept, Dos & Donts, Guidelines for participation and success, Expression of thoughts and ideas, body language and interpersonal & analytical skills		
<b>PRACTICAL NO.03</b>	<b>Group Discussion</b>	<b>4 HOURS</b>
Concept of GD, Criteria for evaluation, types of GD General, Creative and Technical, Dos & Donts, Guidelines for participation and success, Group Dynamics, Expression of thoughts and ideas, body language and interpersonal & analytical skills		
<b>PRACTICAL NO.04</b>	<b>Role Play</b>	<b>4 HOURS</b>
Role-play for verbal communication, team building and group dynamics, decision making, leadership, analytical and creative thinking, group presentation		
<b>PRACTICAL NO.05</b>	<b>Review and Letter Writing</b>	<b>4 HOURS</b>
How to write a review, characteristics and essentials of a good review, writing a review on a book or short story, types of letters- formal, informal; layout of business letters		

<b>PRACTICAL NO.06</b>	<b>Report Writing and Prcis Writing</b>	<b>4 HOURS</b>
Types of reports, format and writing a report, What is prcis writing? Rules of prcis writing		
<b>PRACTICAL NO.07</b>	<b>Essay Writing</b>	<b>2 HOURS</b>
What is an essay? Tips to write a good essay, Types of essays		

#### **REFERENCE BOOK**

1. Michael Swan: Practical English Usage, Oxford, 3rd Edition, ISBN-13: 978-0194420983
2. Raymund Murphy: Essential Grammar in Use, Cambridge, 3rd Edition, ISBN-13: 9780521133890
3. William Sanborn Pfeiffer: Technical Communication A Practical Approach, 6th Edition, Pearson Education, ISBN-13: 978-8131700884
4. Dutt et.al. : A Course in Communication Skills, Foundation, 1st Edition
5. Lynch: Listening, Cambridge, 1st edition, ISBN- 0521707757
6. Malcom Goodale: Professional Presentations, Cambridge, ISBN- 8175962577
7. S. Aggarwal: Essential Communication Skills, Ane Books pvt. Ltd, ISBN- 8180522806
8. Jennings: Communication Basics, Cengage Learning, 1st edition, ISBN- 8131515206

 <b>Academy of Engineering</b> (An Autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2016 - 2017</b>
<b>FIRST YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>	Experimental Tools and Techniques- I
		<b>COURSE CODE</b>	ME102
		<b>COURSE CREDITS</b>	2
<b>RELEASED DATE : 01/06/2016</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
-	4	-	-	30	-	20	50

**PRE-REQUISITE : NIL**

**COURSE OBJECTIVES :**

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ME102.CEO.1: To introduce different tools and study the various measurement techniques.  
 ME102.CEO.2: To study different parts of the system along with its functions and applications.  
 ME102.CEO.3: To list various tools used for the said application.  
 ME102.CEO.4: To identify the function of various parts of system.  
 ME102.CEO.5: To impart comprehensive knowledge for selection of appropriate techniques to the said application.  
 ME102.CEO.6: To apply the knowledge to find the solutions for basic engineering problems.

**COURSE OUTCOMES :**

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

ME102.CO.1: Recall the tools required for measurements. (L1)  
 ME102.CO.2: Summarize the applications of various engineering tools used. (L2)  
 ME102.CO.3: Identify the right tool for selected purpose. (L3)  
 ME102.CO.4: Inspect various parts of the system .(L4)  
 ME102.CO.5: Justify the most appropriate technique which can be compatible with the existing environment. (L5)  
 ME102.CO.6: Develop the system which will give appropriate solution to the identified problem. (L6)

<b>PRACTICALS</b>		
<b>PRACTICAL NO.01</b>	<b>Information Technology/Computer Engineering (Minimum 6 practicals from the following</b>	<b>12 HOURS</b>
<ol style="list-style-type: none"> <li>1. Study and analysis of various components on the motherboard of a standard desktop computer.</li> <li>2. Installation of various components like hard disk drive on the motherboard and check the system setup for verification.</li> <li>3. Formatting the hard disk drive and installation of Windows and Linux operating system making the system dual boot</li> <li>4. Study of various network components like switch, Router and configure the devices.</li> <li>5. Crimping of Unshielded Twisted Pair cable. (Cat-6)</li> <li>6. Study of TCP/IP Stack, and configure as well as develop a Local Area Network.</li> <li>7. Configuration of Network Monitoring tool and checking the results</li> <li>8. Installation of DHCP server and checking the results.</li> <li>9. Installation of web server and checking the results.</li> <li>10. Configuration of MS Access and Deploying Access 2007 Runtime-Based Solutions</li> <li>11. Study and usage of Google Tools (creating Forms, Blog).</li> <li>12. Using the Google form with add on, create a PDF file of the form.</li> <li>13. Designing a static HTML page</li> <li>14. Uploading the pages using FTP server on a web site</li> <li>15. Deploy a simple web site using LAMP server creation of a web site using Google sites.</li> </ol>		
<b>PRACTICAL NO.02</b>	<b>Electronics Engineering (Minimum 6 practicals from the following</b>	<b>12 HOURS</b>
<ol style="list-style-type: none"> <li>1. Basic electronics component and switches</li> <li>2. PCB and Soldering Tools And Technique</li> <li>3. Relay and application</li> <li>4. Manufacturing of extension board/Spike Guard</li> <li>5. Series and parallel connection of Electrical Load</li> <li>6. Actuators and application (Electrical and Mechanical).</li> <li>7. PCB Wizard</li> <li>8. Proteus</li> <li>9. Virtual Instrumentation.</li> <li>10. Cathode Ray Oscilloscope</li> <li>11. Power Supply</li> </ol>		

<b>PRACTICAL NO.03</b>	<b>Mechanical Engineering Laboratories (Minimum 6practicals from the following</b>	<b>12 HOURS</b>
<ol style="list-style-type: none"> <li>1. Linear and angular measurements.</li> <li>2. Types of mechanism and making any one mechanism containing four links using card board.</li> <li>3. Open a household component and explain it with free hand sketches.</li> <li>4. Draw the outline of the problem identified for project on software package.</li> <li>5. Measurement of RPM of rotating machine using contact and non-contact type tachometer.</li> <li>6. Measurement of transmission ratio in Belt drive, Chain drive, and Gear drive.</li> <li>7. Measurement of Barometric pressure, introduction to pressure measuring devices like bourdon tube pressure gauge and manometer. Fabrication of simple type manometer.</li> <li>8. Introduction to temperature measuring devices. Making and calibration of thermo couple and using it with temperature indicator.</li> <li>9. Measurement of Relative humidity of air in the lab.</li> <li>10. Measurement of hardness of Steel and Aluminum.</li> <li>11. Measurement of stiffness of helical spring (compression or tension). Open IT</li> <li>12. Mixer or kitchen machine/ Printer.</li> <li>13. Refrigerator/ Window Air Conditioner.</li> <li>14. Boiler and accessories / thermal power plant (Mini).</li> <li>15. Two stroke or four stroke engine.</li> <li>16. Assembly and Disassembly of parts in any software package.</li> <li>17. Introduction to threaded fasteners and joints using threaded fasteners.</li> </ol>		
<b>PRACTICAL NO.04</b>	<b>Chemical Engineering (Minimum 3 practicals from the following</b>	<b>06 HOURS</b>
<ol style="list-style-type: none"> <li>1. Determination of specific gravity of liquid</li> <li>2. Study of molecular diffusion</li> <li>3. Liquid liquid extraction: Separation of one liquid component from the solution.</li> <li>4. Solid-liquid separation from filtration</li> <li>5. Membrane Separation process</li> <li>6. Fuel from Plastic</li> <li>7. Demonstration of mechanical operation models.</li> <li>8. Production of Biodiesel</li> <li>9. Open and Study Heat Exchangers.</li> <li>10. Water purifier (Household)</li> </ol>		

<b>PRACTICAL NO.05</b>	<b>Civil Engineering (Mimumum 3 Practicals from the following)</b>	<b>06 HOURS</b>
<ol style="list-style-type: none"> <li>1. To find the area and included angle of given plot and fix boundary from given plan.</li> <li>2. To determine the level difference between 5 points with level tube and determine height of tower with trigonometry.</li> <li>3. To draw the plan of given housing to a given scale.</li> <li>4. To draw line diagram of household water supply line and sewage line with list of materials used.</li> <li>5. To draw line diagram of rain water harvesting unit with all details and its importance.</li> <li>6. To make report on daily water requirement in public building and its waste water disposal, and reuse.</li> <li>7. To identify and make report on the earthquake resisting structural members of building and its role.</li> <li>8. To demonstrate the lifesaving dos and donts during the different natural calamities.</li> <li>9. To demonstrate the dos and donts after different natural calamities.</li> </ol>		

### **TEXT BOOK**


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1. Bruce Hallberg, Networking A Beginners Guide , 4th edition, Tata McGraw-Hill,2005, ISBN 0-07-060791-5
2. R.S. Khandpur, Printed Circuit Boards Design, Fabrication, Assembly and Testing, Tata McGraw-Hill Education, 2005, ISBN 0070588147, 9780070588141.
3. S R Dara, Engineering Chemistry, 5th edition, S.Chand , ISBN 81-219-0359-9

### **REFERENCE BOOK**

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1. Mackenzie L. Davis, Water and Wastewater Engineering, 13th edition, Tata McGraw- Hill, ISBN 978-1-25-906483-8
2. R. S. Khurmi, J. K. Gupta, Theory of Machines, 14th edition, S. Chand, ISBN 81-219-2524-X
3. Philip Wankat, Seperation Process Engineering , 3rd edition, Pearson, ISBN 978-93-325-2484-2
4. N.V. Ragvendra, L. Krishnamurthy, Engineering Metrology and Measurements, Oxford University Press, ISBN 978-0-19-808549-2.
5. Dr. Vinod Hosur, Earthquake- Resistant Design of Building Structures, Wiley, ISBN 978-81265-3859-1
6. M. S. Shetty, Concrete Technology, S. Chand, 2008, ISBN 9788121900034.

 <b>Academy of Engineering</b> (An Autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2016 - 2017</b>
<b>FIRST YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>	Design Thinking
		<b>COURSE CODE</b>	ME103
		<b>COURSE CREDITS</b>	2
<b>RELEASED DATE : 01/06/2016</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
-	4	-	-	25	-	25	50

**PRE-REQUISITE : -**

**COURSE OBJECTIVES :**

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ME103.CEO.1: Disseminate the philosophy of design thinking.  
 ME103.CEO.2: Impart the information regarding User centric approach.  
 ME103.CEO.3: Give exposure to information collection tools to clearly define user centric problem.  
 ME103.CEO.4: Enhancethinking in order to inspect diverse solutions.  
 ME103.CEO.5: Sensitize about the feasibility, desirability and viability criterias for selection of appropriate solution.  
 ME103.CEO.6: Educate about different types of prototyping.

**COURSE OUTCOMES :**

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

ME103.CO.1: Recall fundamental principles of design thinking (L1)  
 ME103.CO.2: Explain all the dimensions of user and his needs using design thinking approach (L2)  
 ME103.CO.3: Identify user centric problem by using information gathering techniques (L3)  
 ME103.CO.4: Compare multiple solutions through ideation process (L4)  
 ME103.CO.5: Justify most appropriate solution for defined user centric problem (L5)  
 ME103.CO.6: Develop the most optimum solution (L6)



<b>SESSION</b>		
<b>SESSION 1</b>		<b>2 HOURS</b>
Design thinking Methodology General Problem Statement, Random check list, mind mapping, Categorization of random check list.		
<b>SESSION 2</b>		<b>2 HOURS</b>
Brainstorming of problem areas, Research Methodology Information gathering Primary, Secondary Sources, data presentation, Preparation of survey forms		
<b>SESSION 3</b>		<b>2 HOURS</b>
SWOT analysis, drawing inferences, translation of inferences into design criteria, specific problem statement, Ideation free hand sketching drawing of cuboids, cylinders, simple form products (Isometric views) Ideation sketches, Ergonomic and aesthetic consideration in design		
<b>SESSION 4</b>		<b>2 HOURS</b>
Concept validation, evaluation and detailing, prototyping		

<b>PROJECT</b>		
<b>PHASE NO.01</b>		<b>4 HOURS</b>
General Problem Statement and problem background		
<b>PHASE NO.02</b>		<b>4 HOURS</b>
Research methodology		
<b>PHASE NO.03</b>		<b>4 HOURS</b>
Design Brief		
<b>PHASE NO.04</b>		<b>8 HOURS</b>
Ideation		
<b>PHASE NO.05</b>		<b>4 HOURS</b>
Concept Evaluation, Validation and Concept detailing		
<b>PHASE NO.06</b>		<b>8 HOURS</b>
Prototyping		
<b>PHASE NO.07</b>		<b>8 HOURS</b>
Report Writing		

## **TEXT BOOK**


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1. Engineering Design Process, Second Edition Yousef Haik and Tamer Shahin Publisher, Global Engineering. Cengage Learning. ISBN-13: 978-0-495-66814-5.
2. Product Design and Development, Kevin Otto and Kristin Wood, Product Design: Techniques in Reverse Engineering and New Product Development, Pearson Education Inc. ISBN-10: 0130212717.
3. Product Lifecycle Management, Grieves, Michael, McGraw-Hill, 2006. ISBN 0071452303.
4. Lateral Thinking: Creativity Step by Step Harper Perennial; Reissue edition (24 February 2015) (Perennial Library) Six Thinking Hats by Edward de Bono Paperback ISBN-10: 0060903252.
5. Design Methods, John Chris Jones., John Wiley & Sons, David Fulton Publishers, London, ISBN 0-471-28496-3.

## **Web references**

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1. [www.designcouncil.org.uk](http://www.designcouncil.org.uk)
2. [www.surveymonkey.com](http://www.surveymonkey.com)
3. <http://en.red-dot.org>

 <b>MIT</b> (An Autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>		<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2016 - 2017</b>
<b>FIRST YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>		Mathematics II
		<b>COURSE CODE</b>		AS104
		<b>COURSE CREDITS</b>		5
<b>RELEASED DATE : 01/06/2016</b>		<b>REVISION NO</b>		0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
4	1	40	50	10	25	Nil	125

**PRE-REQUISITE :** Basic elementary Mathematics of XI & XII, Mathematics I

**COURSE OBJECTIVES :**

AS104.CEO.1: To identify different methods to evaluate integrals.  
 AS104.CEO.2: To classify and solve linear differential equations of higher order  
 AS104.CEO.3: To demonstrate an understanding towards evaluating multiple integrals.  
 AS104.CEO.4: To relate and examine the applications of multiple integrals.  
 AS104.CEO.5: Analyse different probability distribution functions.  
 AS104.CEO.6: To study different statistical methods for solving problems

**COURSE OUTCOMES :**

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

AS104.CO.1: Distinguish different methods to evaluate integrals.(L4)  
 AS104.CO.2: Conclude solutions for higher order lineardifferential equations(L4)  
 AS104.CO.3: Evaluate the multiple integrals(L5)  
 AS104.CO.4: Apply the knowledge of multiple integrals wherever required(L3)  
 AS104.CO.5: Solve the probability distribution problems(L3)  
 AS104.CO.6: Assess statistical problems(L5)

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Integral Calculus</b>	<b>8 HOURS</b>
Reduction Formulae , Beta - Gamma functions and Differentiation under integral sign.		
<b>UNIT 2</b>	<b>Linear Differential Equations of higher order</b>	<b>8 HOURS</b>
General solution of Linear Differential equations with constant coefficients, Method of Variation of parameters, Equations reducible to Linear Differential equation with constant coefficients: Cauchy&Legendres linear differential equations		
<b>UNIT 3</b>	<b>Multiple Integrals</b>	<b>8 HOURS</b>
Tracing ofCurves: Cartesian curves, Polar curves, Parametric curves ,Double Integration, Evaluation of Double Integration, Change of order of integration, Integration by transforming Cartesian to Polar Coordinate system, Triple integration, Integration by transforming to spherical and cylindrical polar coordinates		
<b>UNIT 4</b>	<b>Applications of Multiple Integrals</b>	<b>8 HOURS</b>
Applications of multiple integrals to find Area, Volume, Centre of Gravity, and Moment of Inertia		
<b>UNIT 5</b>	<b>Probability</b>	<b>8 HOURS</b>
Probability, probability density function, probability distribution:Binomial, Poisson, Normal .		
<b>UNIT 6</b>	<b>Statistics</b>	<b>8 HOURS</b>
Measures of central tendency, standard deviation, coefficient of variation, moments, skewness and kurtosis, correlation(Karl Pearsons coefficient of correlation) and regression.		

<b>TUTORIAL</b>		
<b>TUTORIAL NO.01</b>		<b>1 HOURS</b>
Examples on Reduction Formulae, Beta and Gamma functions. Examples on Differentiation under integral sign		
<b>TUTORIAL NO.02</b>		<b>1 HOURS</b>
General solution of Linear Differential equations with constant coefficients , Method of Variation of parameters.		
<b>TUTORIAL NO.03</b>		<b>1 HOURS</b>
Equations reducible to Linear Differential equation with constant coefficients: Cauchy- Euler equations		

<b>TUTORIAL NO.04</b>		<b>1 HOURS</b>
Tracing of Cartesian curves .Tracing of Polar and Parametric curves .Double Integration, Evaluation of Double Integration, Change the order of integration.		
<b>TUTORIAL NO.05</b>		<b>1 HOURS</b>
Integration by transforming Cartesian to Polar Coordinate system, Triple integration,Integration by transforming to spherical and cylindrical polar coordinates.Applications of multiple integrals:To find Area, Volume		
<b>TUTORIAL NO.06</b>		<b>1 HOURS</b>
Applications of multiple integrals: To find Centre of Gravity of an arc, plane lamina and a solid.		
<b>TUTORIAL NO.07</b>		<b>1 HOURS</b>
Applications of multiple integrals: To find Moment of Inertia about an arc, plane and solid		
<b>TUTORIAL NO.08</b>		<b>1 HOURS</b>
Probability, probability density function, Probability distribution:Binomial		
<b>TUTORIAL NO.09</b>		<b>1 HOURS</b>
Probabilitydistribution :Poisson, Normal. Measures of central tendency, standard deviation, coefficient of variation		
<b>TUTORIAL NO.10</b>		<b>1 HOURS</b>
Moments, skewness and kurtosis,correlation and regression.		


### **TEXT BOOK**

1. Higher Engineering Mathematics by Dr. B.V. Ramana; Tata McGraw Hill, ISBN: 978-0-07-063419-2
2. Higher Engineering Mathematics by B.S. Grewal, Khanna Publications, 39th edition, ISBN: 81-7409- 195-5

### **REFERENCE BOOK**

1. Calculus by G.B. Thomas &R.L.Finney (ISBN:81-7758-325-5, Pearson Education, 9th edition)
2. Advanced Engineering Mathematics by Erwin Kreyszig, Volume I & II (ISBN-10: 8126543132, ISBN-13: 978-8126543137, Wiley Eastern Ltd.)
3. Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar (ISBN No.: 8173194203, Narosa Publishing house)
4. Advanced Engineering Mathematics by Peter V. ONeil (ISBN-13: 9788131503102, Cenage Learning, 7th Edition)

5. Advanced Engineering Mathematics by Dennis G. Zill& Warren S. Wright; Jones and Bartlett Publishers, 4th edition, ISBN-10: 0-7637-7966-0, ISBN 13: 978-0-7637-7966-5.
6. Higher Engineering Mathematics by B.S. Grewal (ISBN:81-7409-195-5,Khanna Publications,39th edition)
7. Applied statistics and probability for engineers fourth edition by Douglas C. montgomery , George C runger(ISBN No:978-81-265-2315-3 wiley )
8. Miller& Freunds Probability and statistics for engineers by richard A johnson, irwin-miller,johnfreund(ISBN no:978-93325-5041-4,Pearson)

 <b>Academy of Engineering</b> (An Autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2016 - 2017</b>
<b>FIRST YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>	Language and Communication 2
		<b>COURSE CODE</b>	HP102
		<b>COURSE CREDITS</b>	2
<b>RELEASED DATE : 01/06/2016</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
1	2	30	35	10	25	Nil	100

**PRE-REQUISITE :** Basic proficiency in English at the higher secondary school level; Language and Communication- 1

**COURSE OBJECTIVES :**

- HP102.CEO.1: To familiarise the students with sounds in English and introduce phonemic transcription.  
 HP102.CEO.2: CEO.2: To enrich the vocabulary of the students with AWL and NAWL.  
 HP102.CEO.3: To acquaint the students with public speaking, presentation and interview skills in English.  
 HP102.CEO.4: To develop the students reading and listening skills with the use of written audio and video texts.

**COURSE OUTCOMES :**

- The students after completion of the course will be able to,
- HP102.CO.1: Recognise and reproduce the sounds in English effectively. [L1]  
 HP102.CO.2: Choose and employ appropriate words from AWL and NAWL in communication. [L1, L3]  
 HP102.CO.3: Express their ideas effectively and demonstrate skills in interpersonal communication. [L2, L3]  
 HP102.CO.4: Analyse and infer from written, audio and video texts. [L 2, L4]

<b>THEORY</b>		
<b>UNIT 1</b>	<b>Phonetics and Vocabulary</b>	<b>3 HOURS</b>
Phonemes in English and phonemic transcription; Essential academic vocabulary (Academic Word List and New Academic Word List); Dictionary Skills; Phrasal verbs and collocations		
<b>UNIT 2</b>	<b>Oral Communication</b>	<b>4 HOURS</b>
Public Speaking; Presentation Skills; Interview Skills and telephonic communication; Meetings (types, agenda and minutes)		
<b>UNIT 3</b>	<b>Active Listening and Reading with Comprehension</b>	<b>5 HOURS</b>
Concept and types of listening; Steps in listening with comprehension; Essentials of good listening; Concept and types of reading; Guidelines for reading with comprehension; Analytical reading		

<b>PRACTICALS</b>		
<b>PRACTICAL NO.01</b>	<b>Pronunciation and Phonemic Transcription</b>	<b>2 HOURS</b>
Identification of correct pronunciation of words by decoding phonemic scripts; writing phonemic transcriptions of the given words		
<b>PRACTICAL NO.02</b>	<b>Vocabulary Enrichment</b>	<b>2 HOURS</b>
Online exercises on AWL and NAWL using web-based applications; Dictionary Skills		
<b>PRACTICAL NO.03</b>	<b>Phrasal Verbs and Collocations</b>	<b>2 HOURS</b>
Use of phrasal verbs and collocations; reading literary pieces, essays to identify phrasal verbs in context; story-telling		
<b>PRACTICAL NO.04</b>	<b>Public Speaking</b>	<b>2 HOURS</b>
Attributes of a good public speaker; prepared and extemporaneous speech; Listening to and Reading famous speeches		
<b>PRACTICAL NO.05</b>	<b>: Presentations</b>	<b>2 HOURS</b>
Essentials of effective presentations; Data collection and compilation; Preparation of outlines; PPT and Prezi		
<b>PRACTICAL NO.06</b>	<b>Interview Skills and Telephonic Communication</b>	<b>2 HOURS</b>
Etiquettes of attending interviews; Preparation; Telephonic communication; Mock Interviews		



<b>PRACTICAL NO.07</b>	<b>Mock Meetings</b>	<b>2 HOURS</b>
Importance of effective interpersonal communication; working in teams; Mock Meetings		
<b>PRACTICAL NO.08</b>	<b>Active Listening</b>	<b>6 HOURS</b>
Active listening; Conversations, audio and video clips; Listening with comprehension		
<b>PRACTICAL NO.09</b>	<b>Reading with Comprehension</b>	<b>4 HOURS</b>
Techniques of reading- Intensive, Extensive, Skimming and Scanning; Reading Comprehensions		

### **REFERENCE BOOK**

1. Michael Swan: Practical English Usage, Oxford, 3rd Edition, ISBN-13: 978-0194420983
2. Dutt et.al. : A Course in Communication Skills, Foundation, 1 edition
3. Peter Roach: English Phonetics and Phonology, 4th Edition, Cambridge, ISBN-0521149215
4. Lynch: Listening, Cambridge, 1st edition, ISBN- 0521707757
5. Malcom Goodale: Professional Presentations, Cambridge, ISBN- 8175962577
6. S. Aggarwal: Essential Communication Skills, Ane Books pvt. Ltd, ISBN- 8180522806
7. Jennings: Communication Basics, Cengage Learning, 1st edition, ISBN- 8131515206



**MIT ACADEMY OF ENGINEERING, ALANDI**

**An Autonomous Institute Affiliated to**

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**Curriculum**

**For**

**Second Year**

**Bachelor of Technology in  
Mechanical Engineering**

**2016-2020**

**(With Effect from Academic Year: 2017-2018)**

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**SCHOOL OF MECHANICAL & CIVIL  
ENGINEERING**

**W. E. F : 2017-18**

**S Y B TECH**

**RELEASE DATE : 01/06/2017**

**DEPARTMENT OF MECHANICAL ENGG**

**REVISION NO. : 0.0**


**SEMESTER: I**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	PC1	CH201	Environmental Science	2	2	3
2.	PC2	AS201	Applied Mathematics	3	2	4
3.	PC3	ET201	System Engineering	3	2	4
4.	DC1	ME202	Thermal Engineering	3	2	4
5.	DC2	ME203	Solid Mechanics	3	2	4
6.	SDP3	ET206	Prototyping	--	4	2
<b>TOTAL</b>				14	14	21

**SEMESTER: II**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	PC4	IT201	Engineering Informatics	3	2	4
2.	PC5	ME201	Materials Engineering	3	2	4
3.	DC3	ME211	Fluid Mechanics	3	2	4
4.	DC4	ME212	Manufacturing Technology	3	2	4
5.	HSS3	HP201	Psychology	3	--	3
6.	SDP4	ME213	Minor Project	--	4	2
<b>TOTAL</b>				15	12	21

*L: Lecture, P: Practical*

 <b>MIT</b> (An Autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>			<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF CHEMICAL ENGINEERING</b>			<b>W.E.F</b>	<b>AY: 2017-2018</b>
<b>SECOND YEAR BACHELOR OF TECHNOLOGY</b>			<b>COURSE NAME</b>		Environmental Science
			<b>COURSE CODE</b>		CH201
			<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/06/2017</b>			<b>REVISION NO</b>		0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	20	40	15	NIL	50	125

**PRE-REQUISITE :** AS103: Chemistry

**COURSE OBJECTIVES :**

CH201.CEO.1: Give an overview of exploitation of various natural resources and its impact on the environment.

CH201.CEO.2: Understand the ecosystem and biodiversity.

CH201.CEO.3: Understand the importance of environment and its conservation.

CH201.CEO.4: Learn about the environmental pollution sources, effects and control measures.

CH201.CEO.5: Make aware of the national and international issue for the environment.

CH201.CEO.6: Make aware about the social and environmental responsibility.

**COURSE OUTCOMES :**

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

CH201.CO.1: Identify the various human activities adversely affecting the natural resources and the balance ecosystem.

CH201.CO.2: Observe the various aspects of ecosystems and suggest ways to protect them.

CH201.CO.3: Experiment the pollution of given locality and suggest steps to mitigate pollution.

CH201.CO.4: Record the sources of pollution and their controls.

CH201.CO.5: Compare laws and standards for pollution.

CH201.CO.6: Categorize the social and professional responsibility towards environment.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Environment</b>	<b>5 HOURS</b>
Importance of environment, Biosphere, Structure and function of an ecosystem, ecological pyramids, effects of population growth on environment. Natural cycles: hydrologic, carbon, nitrogen, phosphorus and Sulphur cycle. Understanding carbon foot prints, Role of the environmental engineer. Need of environmental legislations and environmental Acts in India. Functions of central and state pollution control boards.		
<b>UNIT 2</b>	<b>Resources</b>	<b>4 HOURS</b>
Natural, conventional and non-conventional, Natural and manmade disasters on environment. Case studies on use and Impact of overutilization of natural resources: Food, forest, water, energy, land.		
<b>UNIT 3</b>	<b>Pollution</b>	<b>4 HOURS</b>
Structure and composition of atmosphere, Pollution, types of pollution, causes of pollution effects, control and prevention. Air, solid and water waste management Pollution prevention and control act.		
<b>UNIT 4</b>	<b>Pollution Impact</b>	<b>5 HOURS</b>
Case study on Nuclear Accidents; floods; land slid; climate change; air pollution in cities, water pollution; noise pollution. Case study on drought situation in Vidarbha-Marathwada.		
<b>UNIT 5</b>	<b>Social Issues</b>	<b>5 HOURS</b>
Case study on Plastic waste management, domestic waste issue, food problem in India & globally. Modernization of agriculture, traffic and pollution, e-waste disposal.		
<b>UNIT 6</b>	<b>Sustainable Development</b>	<b>5 HOURS</b>
Concept of sustainable development. Utilization and conservation of natural resources. Rainwater harvesting & Water management techniques. Role of an individual in environment protection. Energy audit, disaster management.		

<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>	<b>Title: Fukushima Japan Nuclear Accident</b>	<b>2 HOURS</b>
Details of the accident will be discussed with the students. Students are supposed to write a case study report on the incident w. r. t. causes, effects & preventive measures to avoid such type of accidents.		
<b>PRACTICAL NO.02</b>	<b>Title: Malin Land Slide</b>	<b>2 HOURS</b>
Details of the accident will be discussed with the students. Students are supposed to write a case study report on the incident w. r. t. causes, effects & preventive measures to avoid such type of accidents.		
<b>PRACTICAL NO.03</b>	<b>Title: Drought Situation in Vidarbha &amp; Marathwada</b>	<b>2 HOURS</b>
Details of the drought situation will be discussed with the students. Students are supposed to write a case study report on the incident w. r. t. causes, effects & preventive measures to avoid such type of situations.		
<b>PRACTICAL NO.04</b>	<b>Title: River water pollution case study</b>	<b>2 HOURS</b>
Details of the River pollution of Ganga, Indrayani etc. will be discussed with the students. Students are supposed to write a case study report on the various causes of river pollution, preventive measures to avoid this & water treatment methodologies for river water treatment.		
<b>PRACTICAL NO.05</b>	<b>Title: Project</b>	<b>16 HOURS</b>
General solutions of linear differential equations with constant coefficients, Method of variation of parameters.		


### **TEXT BOOKS**

1. Rao C.S. "Environmental Pollution Control Engineering", Wiley Eastern Publications. ISBN: 9780470217634.
2. Kamaraj. P & Arthanareeswari .M, "Environmental Science – Challenges and Changes", 4th Edition, Sudhandhira Publications, 2010.
3. Sharma. B.K. and Kaur, "Environmental Chemistry", Goel Publishing House, Meerut, 1994 ISBN:8182830125.
4. Miller T. G. Jr., "Environmental Science", Wadsworth Publishing Co. ISBN-10: 1111988935 ISBN: 9781111988937
5. Metcalf Eddy "Wastewater engineering: Treatment and reuse", McGraw Hill, ISBN: 007041878.

## REFERENCE BOOKS

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1. Garg, S.K and Garg, R., “Ecological and Environmental Studies”, Khanna Publishers, Delhi, 2006. ISBN: 9788174092182.
2. H. S. Peavy, D. R. Rowe, G. Tchobanoglous, “Environmental Engineering”, McGraw Hill, ISBN: 8428204470.
3. Helen Kavitha. P “Principles of Environmental Science”, Sci tech Publications, 2nd Edition, 2008. ISBN: 9780444430243.
4. Henry J.G. and Heinke G.W., “Environmental Science and Engineering”, 2nd Edition, Prentice Hall of India, New Delhi, 2004, ISBN: 978-0131206502.
5. Masters G.M., “Introduction to Environmental Engineering and Science”, 2nd Edition, Prentice Hall of India, New Delhi, 2004. ISBN: 0131481932 ISBN: 9780131481930.

 <b>MIT</b> (An Autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>		<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2017-2018</b>
<b>SECOND YEAR BACHELOR OF TECHNOLOGY CHEM/CIVIL/MECH ENGG</b>		<b>COURSE NAME</b>		Applied Mathematics
		<b>COURSE CODE</b>		AS201
		<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/06/2017</b>		<b>REVISION NO</b>		0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	50	20	50	-	150

**PRE-REQUISITE : NIL**

**COURSE OBJECTIVES :**

AS201.CEO.1: To find the Laplace transform of continuous time signals (functions).  
 AS201.CEO.2: To determine the Fourier constants and construct the Fourier series.  
 AS201.CEO.3: To construct the integral representation of functions using Fourier transform.  
 AS201.CEO.4: To solve partial differential equations viz. heat and wave equations theoretically.  
 AS201.CEO.5: To apply numerical methods for constructing functions and solving Differential Equations.  
 AS201.CEO.6: To write and execute the program on problems of Laplace, Fourier and numerical methods using MATLAB.

**COURSE OUTCOMES :**

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

AS201.CO.1: Analyze the output response of given linear system using Laplace Transform.  
 AS201.CO.2: Analyze the frequency response of the system using appropriate Fourier transform.  
 AS201.CO.3: Justify the selection of appropriate transform for a given system.  
 AS201.CO.4: Solve and examine the solution of partial differential equations by theoretical methods.  
 AS201.CO.5: Determine the solution of ordinary differential equations using Euler's, Runge-Kutta 4th order and the interpolation using Newton's and Lagrange's interpolating methods.  
 AS201.CO.6: Implement Laplace Transform, Fourier transform and Numerical methods to find the solution of given problem using MATLAB.



<b>THEORY</b>		
<b>UNIT 1</b>	<b>Laplace Transform I</b>	<b>6 HOURS</b>
Introduction of Laplace Transform, Properties: First shifting, Second shifting, Change of scale, Linearity, Multiplication by t, Division by t. Laplace Transform of derivatives, integration, Unit Step function, Impulse Function and Periodic Functions.		
<b>UNIT 2</b>	<b>Laplace Transform II</b>	<b>6 HOURS</b>
Introduction of Inverse Laplace Transform, Properties: First shifting, Second shifting, Change of scale, Linearity, Multiplication by 's', Division by 's'. Inverse Laplace Transform of elementary functions, Derivatives, Integration. Use of partial fractions to find Inverse Laplace Transform. Solution and analysis of linear differential equation to linear system.		
<b>UNIT 3</b>	<b>Fourier Series</b>	<b>6 HOURS</b>
Periodic functions, Fourier series, Dirichlet's conditions, determination of Fourier constants, Half ranges series, Even function series, odd function series, arbitrary period functions series.		
<b>UNIT 4</b>	<b>Fourier Transform</b>	<b>6 HOURS</b>
Introduction of Fourier Transform, Complex exponential form of Fourier series, Fourier Integral Theorem (without proof), Fourier transform and its properties, Fourier Sine Transform, Fourier Cosine Transform, and Inverse Fourier transforms, Fourier Transform of derivatives of a function, Analysis of frequency response.		
<b>UNIT 5</b>	<b>Applications of Partial differential Equations</b>	<b>6 HOURS</b>
One dimensional Heat flow and wave equations by method of separation of variables, Solution of Partial Differential equations by Numerical method: Crank Nicolson method.		
<b>UNIT 6</b>	<b>Numerical Methods</b>	<b>6 HOURS</b>
Interpolation: Finite Differences, Newton's and Lagrange's Interpolation. Numerical solution of System of linear equations by Gauss elimination method and Ordinary differential equations by Euler's, Modified Euler's, Runge-Kutta 4th order methods.		

<b>PRACTICAL: Any 10 practicals are performed as per the requirement of a branch.</b>		
<b>PRACTICAL NO.01</b>		<b>2 HOURS</b>
Introduction to MATLAB: Syntax, keywords, matrices, polynomials, loops.		
<b>PRACTICAL NO.02</b>		<b>2 HOURS</b>
Introduction to MATLAB: In-built functions, 2D/3D plots, creating simple programs.		
<b>PRACTICAL NO.03</b>		<b>2 HOURS</b>
Finding Laplace transforms of functions, solution of differential equations using Laplace transforms.		
<b>PRACTICAL NO.04</b>		<b>2 HOURS</b>
Finding Fourier transforms of functions, Plotting of transforms.		
<b>PRACTICAL NO.05</b>		<b>2 HOURS</b>
Numerical Integration: Trapezoidal, Simpson's 1/3rd and Simpson's 3/8th rule.		
<b>PRACTICAL NO.06</b>		<b>2 HOURS</b>
Interpolation techniques: Lagrange's Interpolation.		
<b>PRACTICAL NO.07</b>		<b>2 HOURS</b>
Interpolation techniques: Newton's Interpolation.		
<b>PRACTICAL NO.08</b>		<b>2 HOURS</b>
Solution of differential equation by modified Euler's method.		
<b>PRACTICAL NO.09</b>		<b>2 HOURS</b>
Solution of differential equation by Runge-Kutta method.		
<b>PRACTICAL NO.10</b>		<b>2 HOURS</b>
Curve Fitting: Linear, Quadratic.		
<b>PRACTICAL NO.11</b>		<b>2 HOURS</b>
Solution of algebraic equations: Newton- Raphson method.		
<b>PRACTICAL NO.12</b>		<b>2 HOURS</b>
Solution of algebraic equations: Bisection method.		
<b>PRACTICAL NO.13</b>		<b>2 HOURS</b>
Curve Fitting: Cubic, Exponential.		

**TEXT BOOK**


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1. Dr. B.V. Ramana, Higher Engineering Mathematics, 5 th edition, Tata McGraw Hill, 2017, ISBN: 978-0-07-063419-0
2. Ram N. Patel and Ankush Mittal, "Programming in MATLAB- A Problem solving approach", Pearson Education, 2014, ISBN-978-93-325-2481-1.

**REFERENCE BOOK**

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1. B.S. Grewal, Higher Engineering Mathematics, 44 th edition, Khanna Publications, 2018, ISBN: 978-81-933284-9-1.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10 th edition, Wiley Eastern Ltd., 2015, ISBN: 13: 9788126554232
3. Amos Gilat, "MATLAB: An Introduction with Applications", 4th edition, Wiley Publication, 2003, ISBN-13: 9788126537204, 8126537205.

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)	<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
	<b>SCHOOL OF ELECTRICAL ENGINEERING</b>	<b>W.E.F</b> <b>AY: 2017-2018</b>
<b>SECOND YEAR BACHELOR OF TECHNOLOGY</b>	<b>COURSE NAME</b>	System Engineering
	<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2017</b>	<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	ICE	ECE	IA			
3	2	30	50	20	NIL	25	125

<b>PRE-REQUISITE :</b>
1: ME102 Engineering Tools and Techniques 2: ME103 Design Thinking

<b>COURSE OBJECTIVES :</b>
ET201.CEO.1: To describe the rationale for using systems thinking for complex adaptive systems ET201.CEO.2: To prioritize with stakeholders in a participatory way for research study ET201.CEO.3: To design system engineering frame work ET201.CEO.4: To apply system engineering tools ET201.CEO.5: To evaluate the system

<b>COURSE OUTCOMES :</b>
The students after completion of the course will be able to,  ET201.CO.1: Explain the rationale for using systems thinking for complex adaptive systems. ET201.CO.2: Analyze interaction with stakeholders in a participatory way for research study. ET201.CO.3: Design System Engineering framework. ET201.CO.4: Apply system engineering tools. ET201.CO.5: Evaluate the system.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction to Systems Thinking</b>	<b>4 HOURS</b>
<p>Introduction to Systems Thinking and Understanding simple systems, Complex and Complex Adaptive Systems, Stakeholders and their engagement.</p> <p><b>Further Reading : Case studies - Public health system, transportation system, solid waste management system.</b></p>		
<b>UNIT 2</b>	<b>System Dynamics Simulation</b>	<b>6 HOURS</b>
<p>Standard test system conceptualization and mapping: an introduction to causal loop diagrams (Systems Thinking Diagrams; Influence Diagrams), principles of stock-and-flow diagrams, Application of stock and flow diagrams to engineering problems, Analysis using agent-based models, Application of systems thinking to policy decision making.</p> <p><b>Further Reading : Case studies - Understand how to use Vensim PLE / Netlogo (Free academic version) to develop causal loop diagrams. Application of Stock and Flow Diagrams to Public Health.</b></p>		
<b>UNIT 3</b>	<b>Introduction to Systems Engineering</b>	<b>8 HOURS</b>
<p>History and definitions, mission of system, types of system, system and its environment, System as a product, Systems Engineering as a profession, System Engineering Process and Management, Life cycle Integration.</p> <p><b>Further Reading: Case studies - London Walkie-Scorchie Skyscraper, BRT system, garbage collection, Unmanned aerial vehicle, Washing machine etc.</b></p>		
<b>UNIT 4</b>	<b>System Engineering Design</b>	<b>8 HOURS</b>
<p>System development process -- Systems engineering method, Systems testing through out development. Requirement Engineering -- Inputs, requirement types, purpose, Requirement analysis, requirement outputs. Case studies – Unmanned Aerial System. Functional Analysis -- Schematic, Functional block diagram. Design Synthesis — Process, Product realization, Product implementation, Product Integration, Product verification, product validation, product transition.</p> <p><b>Further Reading: Development approaches – Waterfall, incremental spiral, evolutionary acquisition.</b></p>		
<b>UNIT 5</b>	<b>System Engineering Tools</b>	<b>8 HOURS</b>
<p>Context diagrams, QFD (Quality function deployment), House of quality, Timeline analysis sheet and requirement allocation sheet, Functional flow diagrams, Design synthesis tools- Concept description sheet (CDS), Functional matrix diagram, Requirement break down structure, N2 diagrams, data flow diagrams, control flow diagrams, behavioral diagrams.</p> <p><b>Further Reading: Popular System life cycle models ( DoD–MIL STD 499B, IEEE 1220 SEP, EIA – 632 SEP, ISO/IEC15288, Professional Engineering model, NASA model, software life cycle models).</b></p>		
<b>UNIT 6</b>	<b>Partial Differential equations.</b>	<b>7 HOURS</b>
<p>Verifying and validating the system, managing the configuration of the system, managing technical risk, project management, ILS (Integrated logistic support).</p> <p><b>Further Reading: Case studies - Aircraft system.</b></p>		

<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>		<b>2 HOURS</b>
Community based causal mapping – Developing causal loop diagrams for health care using Vensim.		
<b>PRACTICAL NO.02</b>		<b>2 HOURS</b>
Developing stock-and-flow diagrams for health care system using Vensim.		
<b>PRACTICAL NO.03</b>		<b>2 HOURS</b>
<p>(Any 02)</p> <ol style="list-style-type: none"> <li>1. Unmanned aerial vehicle</li> <li>2. Conduct some research into the London building known as the “Walkie Scorchie”. Identify what circumstances led to the building earning that unfortunate name and suggest which aspects of the systems engineering process may not have been followed correctly (at least as the issues have been reported in the media).The following links may assist in your investigations.  <a href="http://www.dezeen.com/2013/09/06/we-made-a-lot-of-mistakes-with-this-building-says-walkie-scorchie-architect-vinoly/">http://www.dezeen.com/2013/09/06/we-made-a-lot-of-mistakes-with-this-building-says-walkie-scorchie-architect-vinoly/</a>  <a href="http://www.ibtimes.co.uk/walkie-scorchie-talkie-building-sunlight-london-reflects-504342">http://www.ibtimes.co.uk/walkie-scorchie-talkie-building-sunlight-london-reflects-504342</a>.</li> <li>3. Examine in detail the BRT of New Delhi,Identify what circumstances led to the failure of the system.</li> <li>4. Garbage collection</li> <li>5. Washing machine</li> </ol>		
<b>PRACTICAL NO.04</b>		<b>2 HOURS</b>
Determine the typical structure and contents of the system requirements specification (SyRS) for any one of the case study.		
<b>PRACTICAL NO.05</b>		<b>2 HOURS</b>
Choose an example related to your own discipline and then list and describe three detailed design tools to come up with a satisfactory design for anyone of the case study.		
<b>PRACTICAL NO.06</b>		<b>2 HOURS</b>
We want to modify our house (or from any one of the case studies) by for futuristic requirement to accommodate your children after marriage.Explain how accurate technical data on the house (as confirmed by PCA and FCA ) supports this modification. Explain how the early design stages could have assisted with this modification if expandability/ future growth had been accounted for.		
<b>PRACTICAL NO.07</b>		<b>2 HOURS</b>
<p>Mini project based on society, science and technology problem clubbed with Field visit and presentation (Define problem, data collection, requirement analysis,functional analysis.Design solution, progressive presentation of solution and final presentation).</p> <p>Note: The group of students should be from different program (Multidisciplinary group).</p>		


<b>PRACTICAL NO.08</b>		<b>2 HOURS</b>
Watch the movie The Pentagon wars and write a two page report to assess what aspects System Engineering went wrong. ( <a href="https://www.youtube.com/watch?v=iDYpRhoZqBY">https://www.youtube.com/watch?v=iDYpRhoZqBY</a> ) .		
<b>PRACTICAL NO.09</b>		<b>2 HOURS</b>
Field visit / Industrial visit from system engineering point of view.		
<b>PRACTICAL NO.10</b>		<b>2 HOURS</b>
Working model case study of Quad copter/ aero modeling from system engineering point of view.		

### **TEXT BOOK**

1. John D Sterman, "Business dynamics- Systems Thinking and modelling for a complex world", McGrawHill, ISBN: 007238915X.
2. Weinberg, G.M., An Introduction to General Systems Thinking, New York, NY: Dorset House Publishing, 2001, ISBN-13: 978-0932633491.
3. Alexander Kossiakoff, William N.Sweet, Systems Engineering: Principles and Practice, Wiley, 2009, ISBN-13: 978-8126524532.

### **TEXT BOOK**

1. R. C. Dorf Dennis M Buede, "The Engineering Design of systems", Wiley; 2nd edition, 2002, ISBN- 13: 978-0070530393.
2. International Council of Systems Engineering, Systems Engineering Handbook, A guide for System Life Cycle Processes and Activities, version 3.2.1, January 2011.
3. Department of defense, systems engineering fundamentals, defense acquisition university press (Free e-book), <https://www.scribd.com/document/321957824/SEFGuide-01-01>.
4. Michael Ryschkewitsch, The Art and Science of Systems Engineering, (free e-book), <https://www.nasa.gov/pdf/311198main-Art-and-Sci-of-SE-LONG-1-20-09.pdf>
5. EIA 632 standard - [www.psconsultech.com/yahoo-site-admin/assets/docs/EIA632.9212432.pdf](http://www.psconsultech.com/yahoo-site-admin/assets/docs/EIA632.9212432.pdf)
6. MIL standard - [www.product-lifecycle-management.com/download/mil-std-499b-draft1993.pdf](http://www.product-lifecycle-management.com/download/mil-std-499b-draft1993.pdf).

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>		<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2016 - 2017</b>
<b>SECOND YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>		Thermal Engineering
		<b>COURSE CODE</b>		ME202
		<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/06/2017</b>		<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
3	2	30	50	20	Nil	50	150

**PRE-REQUISITE :** Physics, Applied Mechanics

**COURSE OBJECTIVES :**

ME202.CEO.1: To Identify, use units and notations in Thermodynamics.

ME202.CEO.2: To apply the first and second laws of Thermodynamics to various gas processes and cycles..

ME202.CEO.3: To apply fundamentals of IC engines to enhance its performance-emission characteristics.

ME202.CEO.4: To correlate the properties of steam, dryness fraction measurement and performance estimation of steam generators.

**COURSE OUTCOMES :**

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

ME202.CO.1: Apply concepts and laws of thermodynamics to various thermal processes and real systems.

ME202.CO.2: Formulate performance of various Thermodynamic gas power cycles

ME202.CO.3: Examine the condition of steam and performance of steam generators.

ME202.CO.4: Estimate Stoichiometric air required for combustion of fuels and recent IC engine technologies..



<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Laws of Thermodynamics</b>	<b>6 HOURS</b>
Introduction of thermodynamics, Review of basic definitions, Thermodynamic properties and their units, Zeroth law of thermodynamics, First law of thermodynamics, Steady flow energy equation and its application to different devices. Limitations of First law, Second Law of thermodynamics, Equivalence of Clausius and Kelvin Plank Statement, PMM I and II, Exergy, Review of Heat engine, heat pump and refrigerator.		
<b>UNIT 2</b>	<b>Entropy &amp; Ideal gas</b>	<b>6 HOURS</b>
Entropy as a property, Clausius inequality, Principle of increase of Entropy. Ideal Gas: Ideal Gas Definition Gas Laws: Boyle's law, Charles's law, Avagadro's Law, Equation of State, Ideal Gas constant and Universal Gas constant, Ideal gas processes- on P-V and T-S Diagrams Constant Pressure, Constant Volume, Isothermal, Adiabatic, Polytropic, Throttling Processes, Calculations of heat transfer, work done, internal energy, change in entropy, enthalpy.		
<b>UNIT 3</b>	<b>Gas Power Cycles</b>	<b>6 HOURS</b>
Air Standard Cycle, Efficiency and Mean Effective Pressure, Otto Cycle, Diesel cycle, Dual cycle, Comparison of cycles, Carnot cycle, Rankine cycle, Comparison of Carnot cycle and Rankine cycle, Introduction of Regeneration, Reheating, and Co-generation.		
<b>UNIT 4</b>	<b>Properties of Pure Substances</b>	<b>6 HOURS</b>
Pure substance, Phases of pure substances, Formation of steam, Properties of steam, Use of Steam Tables, Study of P-V, T-S diagram for steam, Dryness fraction and its determination, Study of steam calorimeters (Barrel, Separating, Throttling and combined).		
<b>UNIT 5</b>	<b>I.C. Engine</b>	<b>6 HOURS</b>
Ideal gas mixtures, Combustion, Stoichiometry A/F Ratio, Product of combustion, Enthalpy of combustion, Adiabatic Flame temperature, Review of basic terms of SI & CI engine, stages of combustion in SI & CI engine, abnormal combustion, Recent trends in IC engine technologies like HCCI, EGR, Turbocharging etc.		
<b>UNIT 6</b>	<b>Steam Generators</b>	<b>6 HOURS</b>
Classification and Constructional details of boilers, Mountings and accessories of boiler, Introduction to IBR Act, Boiler draught (natural and artificial draught), Boiler performance calculations-Equivalent evaporation, Boiler efficiency, Energy balance.		

<b>PRACTICAL: Perform the following experiments.</b>		
<b>PRACTICAL NO.01</b>	<b>Joule's experiment</b>	<b>2 HOURS</b>
Joule's experiment to validate first law of thermodynamics.		
<b>PRACTICAL NO.02</b>	<b>Air standard cycle using MATLAB</b>	<b>2 HOURS</b>
Performance estimation of Air standard cycle using standard simulation software's (MATLAB, PHYTHON).		
<b>PRACTICAL NO.03</b>	<b>Engine Test</b>	<b>2 HOURS</b>
Test on Multi cylinder Petrol engine for determination of Friction power.		
<b>PRACTICAL NO.04</b>	<b>Engine Test</b>	<b>2 HOURS</b>
Test on diesel engine to determine various efficiencies, SFC and Heat balance sheet.		
<b>PRACTICAL NO.05</b>	<b>Group task</b>	<b>2 HOURS</b>
Study of recent trends in IC engine technologies like EGR, SCR, HCCI, FSI etc.		
<b>PRACTICAL NO.06</b>	<b>Study Experiment</b>	<b>2 HOURS</b>
Study of Boiler Mountings and Accessories.		
<b>PRACTICAL NO.07</b>	<b>Boiler trial</b>	<b>2 HOURS</b>
Trial on boiler to determine boiler efficiency, equivalent evaporation and Energy Balance.		
<b>PRACTICAL NO.08</b>	<b>Industrial Visit</b>	<b>4 HOURS</b>
Industrial visit to any process industry which uses boiler and submission of detailed report.		


### **TEXT BOOK**

1. P. K. Nag, Engineering Thermodynamics, Tata McGraw Hill Publications, 2008, ISBN 0-07-026062-1
2. Rayner Joel, Basic Engineering Thermodynamics, Pearson Education ltd., 1996, (ISBN 978-81-317-1888-9)
3. Yunus A. Cengel, Thermodynamics – An Engineering Approach, Tata McGraw Hill, 2008, ISBN 0073305375
4. V. Ganesan, Internal Combustion Engines, Tata McGraw-Hill, ISBN 978-1259006197

## REFERENCE BOOK

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1. Hawkins G. A, Engineering Thermodynamics, John Wiley and Sons, 1986, ISBN 0471812021
2. Material Science & Van Wylen, Sonntag R. E, Fundamentals of Classical Thermodynamics, John Wiley and Sons, 1978, ISBN 0471047945
3. T.D. Eastop and A. McConkey, Applied Thermodynamics, Addison Wesley Longman, 2009, ISBN 978-81-7758-238-3
4. Lynn D. Russell, Engineering Thermodynamics, Oxford University Press, 2007, ISBN 0195689054
5. Heywood, Internal Combustion Engine Fundamentals, Tata McGraw-Hill, ISBN 978-1259002076

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>		<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2017-2018</b>
<b>SECOND YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>		Solid Mechanics
		<b>COURSE CODE</b>		ME203
		<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/06/2017</b>		<b>REVISION NO</b>		0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	50	20	Nil	50	150

**PRE-REQUISITE :** Physics, Applied Mechanics

**COURSE OBJECTIVES :**

ME203.CEO.1: To remember the fundamentals of static equilibrium and material constitutive behavior.

ME203.CEO.2: To understand the various types of stresses developed in the mechanical elements.

ME203.CEO.3: To construct shear forces and bending moment diagrams.

ME203.CEO.4: To analyze concept of Slope and Deflections, Bending and Shear stresses for different channels.

ME203.CEO.5: To decide suitable dimensions for Column and shaft.

**COURSE OUTCOMES :**

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

ME203.CO.1: Memorize the concepts of static equilibrium, geometry of deformation, and material constitutive behavior.

ME203.CO.2: Understand the concept of resistance, deformation and thermal stresses and Principal Stresses.

ME203.CO.3: Construct shear forces and bending moment diagrams.

ME203.CO.4: To analyze concept of Slope and Deflections, Bending and Shear stresses in beams for different channels.

ME203.CO.5: Judge suitable dimensions for Column, solid and hollow circular shafts for mechanical systems.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Simple Stresses and Strains</b>	<b>8 HOURS</b>
<p>Concept of Resistance and deformation, stress tensor, Determinate and Indeterminate problems in Tension and Compression - Thermal Stresses - pure shear – Young’s modulus of elasticity, Poisson’s ratio, Modulus of rigidity and Bulk modulus - Relation between elastic constants - Stress-strain diagrams for brittle and ductile materials - working stress.</p>		
<b>UNIT 2</b>	<b>Principal Stresses and Strains</b>	<b>6 HOURS</b>
<p>Normal &amp; shear stresses on any oblique plane. Concept of principal planes, derivation of expression for principal stresses &amp; maximum shear stress, position of principal planes &amp; planes of maximum shear. Graphical solution using Mohr’s circle of stresses. Principal stresses in shaft subjected to torsion, bending moment &amp; axial thrust (solid as well as hollow), Concept of equivalent torsional and bending moments. Theories of elastic failure: Maximum principal stress theory, maximum shear stress theory, maximum distortion energy theory, maximum principal strain theory, maximum strain energy theory – their applications &amp; limitations.</p>		
<b>UNIT 3</b>	<b>Shear Forces and Bending Moments</b>	<b>6 HOURS</b>
<p>Shear forces &amp; bending moment for statically determinate beams due to concentrated loads, uniformly distributed loads, uniformly varying loads &amp; couples, Relationship between rate of loading, shear force and bending moment. Positions of point of contra shear &amp; positions of points of contra flexure.</p>		
<b>UNIT 4</b>	<b>Bending Stresses and Shear Stresses in Machine Elements</b>	<b>6 HOURS</b>
<p>Bending stresses: Theory of simple bending, assumptions, derivation of flexural formula, Modulus of rupture, section modulus, second moment of area of different cross sections with respective centroidal &amp; parallel axes, bending stress distribution diagrams, moment of resistance &amp; section modulus Shear stresses: Concept, derivation of shear stress distribution formula, shear stress distribution diagrams for varying sections, maximum and average shears stresses, shear stress diagram for different cross section, Shear connectors.</p>		
<b>UNIT 5</b>	<b>Slope &amp; Deflection of beams and Column</b>	<b>8 HOURS</b>
<p>Relation between BM &amp; slope, slope &amp; deflection of determinate beams, standard loading cases using Macaulay’s method and Moment Area method, deflection due to shear. Buckling of columns: Concept of buckling of columns, Euler’s formula for buckling load for column with hinged ends, concept of equivalent length for various end conditions, Limitations of Euler’s formula, Rankine’s formula (Only theoretical treatment)</p>		
<b>UNIT 6</b>	<b>Torsion of Circular Shafts</b>	<b>6 HOURS</b>
<p>Stresses, strain &amp; deformations in determinate shafts of solid &amp; hollow, homogeneous &amp; composite circular cross section subjected to twisting moment, derivation of torsion equation, stresses due to combined torsion, bending &amp; axial force on shafts. Strain energy due to bending and torsion Finite Element Modeling -One Dimensional Problem, Assembly of Global Stiffness Matrix and Load Vector, Properties of Stiffness Matrix, Finite Element Equations. Introduction to Strain gauges.</p>		

<b>PRACTICAL:</b>		
<b>Part A: Experimental Approach</b>		
<b>PRACTICAL NO.01</b>	<b>Tensile Test</b>	<b>2 HOURS</b>
Tension test for ductile and brittle material on Universal Testing Machine.		
<b>PRACTICAL NO.02</b>	<b>Shear Test</b>	<b>2 HOURS</b>
Shear test of ductile material on Universal Testing Machine.		
<b>PRACTICAL NO.03</b>	<b>Verification of Flexural Formula</b>	<b>2 HOURS</b>
Experimental verification of flexural formula in bending for simply supported beam or cantilever beam.		
<b>PRACTICAL NO.04</b>	<b>Torsion Test</b>	<b>2 HOURS</b>
Verification of torsional formula on circular bar for different materials.		
<b>PRACTICAL NO.05</b>	<b>Strain Gauge</b>	<b>2 HOURS</b>
Determination of stresses in beams for different end conditions using strain gauges.		
<b>Part B: Computational Approach</b>		
<b>PRACTICAL NO.01</b>	<b>FEA analysis of 1D Elements</b>	<b>4 HOURS</b>
Computational stress analysis of (1D) axially loaded structural member using any FEA software. OR		
<b>PRACTICAL NO.02</b>	<b>FEA analysis of 2D Elements</b>	<b>2 HOURS</b>
Stress and deflection analysis of 2D structure using any FEA software.		
<b>PRACTICAL NO.03</b>	<b>Slope and Deflection by using MD Solid Software</b>	<b>2 HOURS</b>
Determination of slope and deflection using any software package.		
<b>Part C: Analytical Approach</b>		
<b>PRACTICAL NO.01</b>	<b>Principal Stresses</b>	<b>2 HOURS</b>
Principal stresses through graphical and analytical method. OR		
<b>PRACTICAL NO.02</b>	<b>Shear Force and Bending Moment Diagram</b>	<b>2 HOURS</b>
Shear force and bending moment diagrams for beams with different end conditions.		
<b>PRACTICAL NO.03</b>	<b>Slope and Deflection</b>	<b>2 HOURS</b>
Slope and deflection for beams with different end conditions.		

**TEXT BOOK**


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1. G. H. Ryder, Strength of Materials, 3rd Edition, Macmillan Pub, India, ISBN-13: 978-0333109281
2. S.S. Rattan, Strength of Material, Tata McGraw Hill Publication Co. Ltd. ISBN-13: 978-0071072564
3. S. Ramamurtham, Strength of material, Dhanpat Rai Publication, ISBN-13: 978-8187433545
4. Timoshenko and Young, Strength of Materials, CBS Publication, ISBN-13: 978-0442085476

**REFERENCE BOOK**

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1. Beer and Johnston, Strength of materials, CBS Publication, ISBN-13: 978-0070042841
2. E.P. Popov, Introduction to Mechanics of Solids, Prentice Hall Publication, ISBN-13: 978-0134877693
3. Singer and Pytel, Strength of materials, Harper and row Publication, ISBN-13: 978-0495667759

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>		<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF COMPUTER ENGINEERING AND TECHNOLOGY</b>		<b>W.E.F</b>	<b>AY: 2017-2018</b>
<b>SECOND YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>		Prototyping
		<b>COURSE CODE</b>		ET206
		<b>COURSE CREDITS</b>		02
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>		1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
-	4	-	-	-	-	75	75

**PRE-REQUISITE :**

1. ME101 - Engineering Graphics
2. ME102 - Engineering Tools and Techniques
3. ME103 - Design Thinking
4. EX101 - Electrical and Electronics Engineering
5. CV101 - Applied Mechanics
6. IT101 - Computer Programming

**COURSE OBJECTIVES :**

ET206.CEO.1: Learn about materiality and techniques.

ET206.CEO.2: Justify the product development cycle through prototype project.

ET206.CEO.3: Inculcate implementation of skills by proper budget planning with effective troubleshooting and practices in aesthetics & ergonomics.

ET206.CEO.4: Develop abilities to transmit technical information clearly and test the same by delivery of presentation based on the prototype Project.

**COURSE OUTCOMES :**

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

ET206.CO.1: Consolidate the techniques, skills and modern engineering tools.

ET206.CO.2: Apply acquired skills to the construction of a prototype project.

ET206.CO.3: Develop a prototype project by performing tasks in team.

ET206.CO.4: Demonstrate the work carried out in a team.



<b>PRACTICAL:</b>		
<b>Course Introduction:</b>		
<p>This course is aiming at a Project Based Learning methodology. Through a series of projects, students will learn to design, build, and debug engineering prototype systems. They will cover multiple aspects of the prototyping process.</p> <p>Students will complete four modules in rotational manner,</p> <ol style="list-style-type: none"> <li>1. Mechanical Prototyping (MP)</li> <li>2. Electronic Prototyping (EP)</li> <li>3. Software Prototyping(SP)</li> <li>4. Civil Prototyping(CP)</li> </ol> <p>Each module will have on an average six laboratory sessions. The students will complete them in rotational manner. Every module will award for 75 marks.</p> <p><b>Marks of all four course modules will be averaged and if student secures passing marks (passing grade) after averaging; then the required credits of the course will be earned.</b></p>		
<b>MODULE: 1/4</b>	<b>Mechanical Prototyping (MP)</b>	<b>28 HOURS</b>
<b>PRACTICAL:</b>		
<b>PRACTICAL NO. 01</b>	<b>Introduction to prototyping</b>	<b>02 HOURS</b>
<ol style="list-style-type: none"> <li>1. Introduction to Prototyping, traditional prototyping vs. advance rapid Prototyping, different types of prototyping techniques (clay modeling, casting, carpentry, metal art etc.) and their working principle.</li> <li>2. Suitable materials and their properties.</li> <li>3. Applications and need of prototype in emerging field like Bio - medicals, defense, manufacturing, aerospace etc.</li> <li>4. Formation of a group of 5 students per project team.</li> </ol>		
<b>PRACTICAL NO. 02</b>	<b>Design of models</b>	<b>04 HOURS</b>
<ol style="list-style-type: none"> <li>1. Introduction of CAD software and its interaction with prototype machine.</li> <li>2. 3D Modeling using CAD software package.</li> <li>3. Identify physical constraints of prototyping</li> </ol>		

<b>PRACTICAL NO. 03</b>	<b>Preprocessing of prototype</b>	<b>06 HOURS</b>
<ol style="list-style-type: none"> <li>1. Generating STL files from the 3D models &amp; working on STL files.</li> <li>2. Pre-Processing the 3D Model in KISSlicer / Cuba software.</li> <li>3. Suitable filament selection and its properties.</li> </ol>		
<b>PRACTICAL NO. 04</b>	<b>Orientation and support generation</b>	<b>04 HOURS</b>
<ol style="list-style-type: none"> <li>1. Operate Repeater / Cuba software, Selection of Orientation, Supports generation.</li> <li>2. Slicing pattern, tool path generation, G Code and gives input to prototype machine for actual part/object manufacturing.</li> </ol>		
<b>PRACTICAL NO. 05</b>	<b>Assembly of model</b>	<b>08 HOURS</b>
<ol style="list-style-type: none"> <li>1. Complete machine setup.</li> <li>2. Hands on experience of rapid prototype machine for part/object, assembly manufacturing.</li> <li>3. Material selection, cost benefit analysis for prototyping, financial aspect.</li> </ol>		
<b>PRACTICAL NO. 06</b>	<b>Project presentation</b>	<b>04 HOURS</b>
<ol style="list-style-type: none"> <li>1. Final Presentation and report submission (assessment).</li> </ol>		

#### REFERENCE BOOK

1. Rapid Prototyping: Principles and Applications in Manufacturing, Chua C K, Leong K F, Chu S L, World Scientific, ISBN-13: 978-9812778987.
2. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Gibson D W Rosen, Brent Stucker, Springer, ISBN: 978-1-4419-1119-3.
3. Rapid Prototyping: Principles and Applications in Manufacturing, Noorani R, John Wiley & Sons, ISBN: 978-0-471-73001-9.
4. Rapid Tooling: Technologies and Industrial Applications, Hilton P, Jacobs P F, CRC press. ISBN: 978-0824787882
5. Rapid Prototyping and Engineering applications: A tool box for prototype development, Liou W L, Liou F W, CRC Press, ISBN: 978-0849334092.
6. Rapid Prototyping: Theory & practice, Kamrani A K, Nasr E A, Springer, ISBN: 978-0-387-23291-1.
7. Kenneth Cooper, Rapid Prototyping Technology: Selection and Application, Marcel Dekker, Inc. New York, ISBN: 082470261.

<b>MODULE: 2/4</b>	<b>Electronic Prototyping (EP)</b>	<b>28 HOURS</b>
<b>PRACTICAL:</b>		
<b>PRACTICAL NO. 01</b>	<b>Introduction to design and construction of electronic prototyping</b>	<b>02 HOURS</b>
<ol style="list-style-type: none"> <li>1. Gain familiarity with basic stages; Conceptualization, Detailed Design and Implementation.</li> <li>2. Acquire concepts of basic processes in electronic prototyping.</li> <li>3. Form a group of students. (03 max)</li> <li>4. Perform Brainstorming and develop a simple electronic product idea based on given pre-declared theme in given time span.</li> <li>5. Develop a plan for construction of electronic proto from a concept.</li> </ol>		
<b>PRACTICAL NO. 02</b>	<b>Basic electronic prototyping skills</b>	<b>02 HOURS</b>
<ol style="list-style-type: none"> <li>1. Soldering <ul style="list-style-type: none"> <li>• Demonstrate structure of solder wire, soldering temperature, soldering station and gun.</li> <li>• Highlight Industrial safety norms, use of lead free solder, extractor fan etc.</li> <li>• Use of flux, desoldering gun, desoldering techniques, removing components/wires.</li> <li>• Fix Solder defects and inspect quality of solder joints.</li> </ul> </li> <li>2. Wiring <ul style="list-style-type: none"> <li>• Cleaning, stripping and tinning the wires.</li> <li>• Connections and protections for wires.</li> <li>• Using cable ties , heat shrink tubes, sleeves and other wire dressing techniques.</li> </ul> </li> <li>3. Breadboard <ul style="list-style-type: none"> <li>• Bending wires and making connections on breadboards.</li> <li>• Placing components on breadboards.</li> <li>• Testing circuits using breadboards.</li> </ul> </li> <li>4. Perfboards <ul style="list-style-type: none"> <li>• Wire connections and component assembly on perfboards.</li> <li>• Debugging assembled circuit and increasing stability.</li> </ul> </li> </ol>		

<b>PRACTICAL NO. 03</b>	<b>PCB design using basic Electronic Design Automation (EDA)tools</b>	<b>04 HOURS</b>
<ol style="list-style-type: none"> <li>1. Gain familiarity with PCB Design software.</li> <li>2. Draw schematics for PCB design.</li> <li>3. Make PCB layout as per circuit diagram.</li> <li>4. Learn PCB design standards.</li> <li>5. Export PCB files like gerber (.gbr), .pdf etc.</li> </ol>		
<b>PRACTICAL NO. 04</b>	<b>PCB fabrication</b>	<b>08 HOURS</b>
<ol style="list-style-type: none"> <li>1. Develop negative imprints of top and bottom sides and expose to PCB.</li> <li>2. Perform etching process for PCB.</li> <li>3. Perform cleaning and shearing for required size.</li> <li>4. Check continuity of tracks.</li> <li>5. Use drilling machine to make drills.</li> </ol>		
<b>PRACTICAL NO. 05</b>	<b>Assembly and testing of electronic proto</b>	<b>08 HOURS</b>
<ol style="list-style-type: none"> <li>1. Make assembly of electronic prototype as per IPC 610 D.</li> <li>2. Insert components, perform lead cutting with standard clearance.</li> <li>3. Review mechanical fitment of PCB with component insertion.</li> <li>4. Solder components and make wiring.</li> <li>5. Test prototype for electrical functionality, to perform rework if required.</li> <li>6. Assemble PCB with mechanical fitments and assemblies.</li> <li>7. Analyze performance and compare with specifications.</li> </ol>		
<b>PRACTICAL NO. 06</b>	<b>Final project presentation</b>	<b>04 HOURS</b>
<ol style="list-style-type: none"> <li>1. Demonstrate an electronic prototype in a team.</li> <li>2. Write a report on implementation of prototype. (10-15 pages max)</li> <li>3. Present prototype implementation in a team by Power Point presentation.</li> <li>4. Enumerate proposed specifications of electronic prototype.</li> <li>5. Highlight financial aspects including proposed cost and bill of material.</li> </ol>		

**REFERENCE BOOK**

1. Printed Circuit Boards: Design and Technology, Walter C. Bosshart, Tata McGraw-Hill Education, 1983, ISBN: 978-0074515495.
2. Electronic Assembly Fabrication, Charles A. Harper, 1st ed., McGraw-Hill Education, 2002 ISBN: 978-0071378826.
3. Soldering in Electronics Assembly, Frank Riley, 1st ed., Springer, 2013, ISBN: 978-3-662-13163-3.
4. Electronic Techniques: Shop Practices and Construction, R. S. Villanucci, A. W. Avtgis, W.F. Megow, 6th ed., Practice-Hall, 1999. ISBN: 978-0130195661.
5. Printed Circuit Boards: Design, Fabrication, and Assembly, R. S. Khandpur, 1st ed. McGraw-Hill Education, 2005, ISBN: 978-0071464208.
6. Practical Electronics for Inventors, Paul Scherz , Simon Monk ,3rd Edition, McGraw-Hill Education, 2013, ISBN 978-0071771337 (Available on TAB edition, Kindle)
7. IPC-J-STD-001E-2010, Requirements for Soldered Electrical and Electronic Assemblies, IPC. , ISBN: 9781580986922.
8. IPC-A-610 D-2014, Acceptability of Electronic Assemblies, IPC. ISBN: 9781611931549.

<b>MODULE: 3/4</b>	<b>Software Prototyping (SP)</b>	<b>28 HOURS</b>
<b>PRACTICAL:</b>		
<b>PRACTICAL NO. 01</b>	<b>Introduction to software engineering</b>	<b>04 HOURS</b>
Concepts, Software development life cycle (SDLC). Student need to use AEIOU Framework (Design Thinking) to decide the problem statement. Students will work in group of three on AEIOU framework		
<b>PRACTICAL NO. 02</b>	<b>Design UML Diagrams for given problem statement</b>	<b>04 HOURS</b>
Students have to work in group on Project Development canvas and then design following, <ol style="list-style-type: none"> <li>1. Creation of data Flow diagram</li> <li>2. Creation of block diagram</li> <li>3. Design a Activity Diagram</li> </ol>		
<b>PRACTICAL NO. 03</b>	<b>Requirement analysis</b>	<b>04 HOURS</b>
<ol style="list-style-type: none"> <li>1. Find the requirement specification of given problem statement and formulate the feasible solution.</li> <li>2. Paper (low-fidelity) prototype: choose the interface intend to develop, giving the reasons (pros and cons) and describing it summarily - choose the similar interface, indicating its key characteristics.</li> </ol>		

<b>PRACTICAL NO. 04</b>	<b>Design analysis</b>	<b>06 HOURS</b>
<ol style="list-style-type: none"> <li>1. Make an Inspiration board.</li> <li>2. Start an inspiration board by listing 5-10 words that relate to your design idea or point of view. These words can be anything – from similar designs to feelings that the idea evokes.</li> <li>3. Once you’ve listed your words, come up with at least five inspirations, and share them by providing links or images within your assignment submission. For each inspiration, give a brief (1-2 sentences) and insightful explanation of why you chose it (What did you take away from it? What did you learn from it. In other words, why did it inspire you?). Each of these inspirations should offer a different perspective to the design you are working on.</li> </ol>		
<b>PRACTICAL NO. 05</b>	<b>Design analysis</b>	<b>06 HOURS</b>
<ol style="list-style-type: none"> <li>1. Create Storyboards</li> <li>2. A storyboard is a comic-strip-like set of drawings about what interface does and how it is used to accomplish tasks in a real usage scenario. A good storyboard should clearly demonstrate who the user is, the usage situation, and the user’s motivations for using the interface. It should show what the user can accomplish with interface, but it needn’t (and often shouldn’t) show a specific user interface design. For a storyboard including an app screen, the details of the screen are not relevant, but what those screens enable you to accomplish is. Each storyboard should comprise 5-8 panels and will provide all details of end product.</li> </ol>		
<b>PRACTICAL NO. 06</b>	<b>Presentation</b>	<b>04 HOURS</b>
<ol style="list-style-type: none"> <li>1. Each group will be given 10 min to present their work.</li> </ol>		

## REFERENCE BOOK

1. Software Engineering A practitioner's Approach, Roger S, Pressman, 7th Edition, ISBN: 978-0-07-337597-7
2. Effective prototyping for software Makers, Jonathan Arnowitz, MichaleArent by, ACM Digital Library,ISBN-13:978-0120885688
3. Rapid prototyping: Principles and applications in manufacturing, Chua, C. K., Leong, K. F. (1997). New York: Wiley, ISBN: 978-9812778987.
4. Fab - The coming revolution on your desktop - from personal computer to personal fabrication, Gershenfeld, N. (2005). New York: Basic Books. ISBN:978-0465027453
5. Rapid prototyping: Principles and applications, Noorani, R. (2006). Hoboken, NJ: Wiley.ISBN: 978-0-471-73001-9.
6. Rapid manufacturing: The technologies and applications of rapid prototyping and rapid tooling, Pham D. T.,Dimov S. S. (2001). New York: Springer. .ISBN: 978-1447111825
7. Digital design and manufacturing: CAD/CAM applications in architecture and design, Schodek D., Bechthold M., Griggs K., Kao K. M., Steinberg M. (2005). Hoboken, NJ: Wiley , ISBN: 978-0471456360

<b>MODULE: 4/4</b>	<b>Civil Prototyping (CP))</b>	<b>28 HOURS</b>
<b>PRACTICAL:</b>		
<b>PRACTICAL NO. 01</b>	<b>Introduction to civil prototyping</b>	<b>04 HOURS</b>
Introduction of bamboo as a construction material, its physical, mechanical properties, selection, seasoning and treatment, testing, joinery, case studies of bamboo buildings.		
<b>PRACTICAL NO. 02</b>	<b>Analysis of determinant trusses.</b>	<b>04 HOURS</b>
Study of different types of trusses, analysis of determinant trusses by method of joint and method of section		
<b>PRACTICAL NO. 03</b>	<b>Design bamboo trusses</b>	<b>04 HOURS</b>
Design of different bamboo trusses (span more than 3m), Hands on for different types of joinery, axial and angular joints by different methods		
<b>PRACTICAL NO. 04</b>	<b>Making bamboo truss</b>	<b>08 HOURS</b>
Making of bamboo truss		
<b>PRACTICAL NO. 05</b>	<b>Testing bamboo truss</b>	<b>04 HOURS</b>
Testing of different bamboo truss		

<b>PRACTICAL NO. 06</b>	<b>Final project presentation</b>	<b>04 HOURS</b>
Comparative study of analytical and test results of forces in truss members, final project presentation.		


### REFERENCE BOOK

1. Vector mechanics for Engineers: statics and dynamics by Beer & Johnston 10th edition, McGraw Hill Education , ISBN: 978-0073398242
2. Bamboo Architecture & Design (Architecture & Materials), by Chris van Uffelen, , ISBN: 978-3037681824
3. Designing and Building with Bamboo ,Jules J.A. Janssen Technical University of Eindhoven Eindhoven, The Netherlands, ISBN 978-8186247464
4. Codes and standards
5. IS 1902:1993.Code of Practice for preservation of bamboo and cane for non-structural purposes.
6. IS 6874:1973 Methods of test for round bamboos
7. IS 7344:1974 Specification for bamboo tent bamboos.
8. IS 8242:1976 Methods of tests for split bamboos
9. IS 8295 (Part 1): 1976 Specification for bamboo chicks
10. ISO 22157 Standard guidelines for tensile, compressive, shear and bending Strength Parallel to grain and Perpendicular to grain.

### REFERENCE

1. Paris Agreement ([http://unfccc.int/paris agreement/items/9485.php](http://unfccc.int/paris%20agreement/items/9485.php))
2. Kyoto Protocol([http://unfccc.int/kyoto protocol/items/2830.php](http://unfccc.int/kyoto%20protocol/items/2830.php))
3. Green Building Objectives & Checklist, Auroville Bamboo Centre, Pudducherry, Tamil-nadu.(<http://aurovillebamboocentre.org/>)



 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>		<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF COMPUTER AND ENGINEERING AND TECHNOLOGY</b>		<b>W.E.F</b>	<b>AY: 2017 - 2018</b>
<b>SECOND YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>		Engineering Informatics
		<b>COURSE CODE</b>		IT201
		<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/06/2017</b>		<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
3	2	30	50	20	Nil	25	125

**PRE-REQUISITE :**  
 IT101 – Computer Programming, ME102 – Engineering Tools and Techniques

**COURSE OBJECTIVES :**

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IT201.CEO.1: To introduce facts, concept and theory of an information system.  
 IT201.CEO.2: To understand evolution of an information system.  
 IT201.CEO.3: To explain an information life cycle.  
 IT201.CEO.4: To develop IoT based information system.

**COURSE OUTCOMES :**

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

IT201.CO.1: Interpretation of Data, Information and Knowledge. [Apply]  
 IT201.CO.2: Make use of data acquisition techniques for an information system. [Apply]  
 IT201.CO.3: Categories different storage techniques. [Analyze]  
 IT201.CO.4: Develop dashboard for effective communication of information. [Apply]  
 IT201.CO.5: Determine components of Human computer interaction. [Evaluate]  
 IT201.CO.6: Design IoT based information system. [Analyze].

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Evolution Of Information</b>	<b>6 HOURS</b>
Data, Types of Data: Primary data, Secondary data, Meta data, Operational data and Derived data Information: Life Cycle, Semantics of information, Knowledge Data forms: Analog and Digital (Telephone and Stenography) ADC, DAC Evolution of Information- Man Machine Interaction Self-Study: Grade Sheet Generation system <b>Further Reading: Railway reservation, Inventory machine</b>		
<b>UNIT 2</b>	<b>Information Generation</b>	<b>6 HOURS</b>
Data Acquisition, Human interface, Hardware Interface: Input / Output devices Data Transformation: Rearranging, Classifying, Calculating, Summarizing; Self-Study: Weather forecasting System <b>Further Reading: Data Acquisition Applications</b>		
<b>UNIT 3</b>	<b>Information Storage And Transmission</b>	<b>4 HOURS</b>
Need of data storage, Types of storage: stand alone, centralized, distributed, and cloud. Encryption and decryption (define and need) Transmission Type, Synchronous, Asynchronous, Serial, Parallel, Satellite, radio <b>Case Study:</b> Dial up, Broadband <b>Self-Study:</b> Stand Alone and Disk storage <b>Further Reading:</b> Wireless-(Bluetooth, XBEE)		
<b>UNIT 4</b>	<b>Information Visualization</b>	<b>4 HOURS</b>
Representations: Graphs and Charts: Pi Chart, Scatter plot, Histogram, Heat map, Maps, Geo maps Case Study: Dynamic dashboard <b>Further Reading:</b>		
<b>UNIT 5</b>	<b>Human Computer Interface</b>	<b>4 HOURS</b>
Introduction of HCI, Types – mobile, stand-alone, computer etc, Interactive devices – touch screen, mic, keys, keyboard, scanner, camera etc., HCI design principles- standards, Usability principles –portability, scalability, GUI design and evaluation, Interactive Multimedia document search- image, audio, video, animation Case study: Ticket Generation Kiosk Self-Study: Web based systems interactivity <b>Further Reading:</b> Usable GUI Design		
<b>UNIT 6</b>	<b>Internet Of Things</b>	<b>4 HOURS</b>
IoT: Overview, Characteristics and Architecture Embedded Devices: Sensors, Actuators, Arduino and RaspberryPI IOT Ecosystem: Basic elements / building blocks of IOT application, Systematic method to design IOT application Applications: Asset management, Industrial automation, Smart cities Self- Study:IoT Essentials. <b>Further Reading: IOT and big Data</b>		

<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>	<b>Data Acquisition , Storage and Retrieval Systems</b>	<b>8 HOURS</b>
<p>In traditional manual information systems, the storage, retrieval, and update operations on elementary data item, records and files are handled manually. In the context of automation, design an information system that summarizes data while providing storage and retrieval facilities for offline analysis. This automated information system should follow:</p> <ul style="list-style-type: none"> <li>• Identification of an interdependent elementary data items which have facts and figure</li> <li>• Data collection through sensors</li> <li>• Processing using Arduino</li> <li>• Data Storage using MySQL in an accessible form</li> <li>• Data visualization using graphs</li> </ul>		
<b>PRACTICAL NO.02</b>	<b>Dashboard Design</b>	<b>8 HOURS</b>
<p>Over the last year, the three locations of fast-food restaurant have produced mixed financial results. You have been asked to analyze the performance data from each location and identifying the causes of these results. For the same, design the dashboard to monitor key performance indicators for given system.</p>		
<b>PRACTICAL NO.03</b>	<b>IoT Application</b>	<b>8 HOURS</b>
<p>Deploy an IoT based automation system for controlling home appliances such as fan, lights, water pumps, etc. using Raspberry Pi.</p> <ol style="list-style-type: none"> <li>1. Identify the home appliances that require human interaction for its operations and state the need of automation.</li> <li>2. Identify system component</li> <li>3. Design circuit diagram</li> <li>4. Assemble system components</li> <li>5. Program the interface</li> <li>6. System Testing</li> <li>7. System Deployment</li> </ol>		

**TEXT BOOK**


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1. Ralph M Stair, George W Reynolds, "Fundamentals of Information Systems", Course Technology Inc; 5th edition, 2008, ISBN 978-1423925811.
2. Benny Raphael, Ian F. C. Smith, "Engineering Informatics: Fundamentals of Computer-Aided Engineering", Wiley-Blackwell; 2nd Revised edition, 2013, ISBN-13: 978-1119953418.
3. Paul Mcfedries, "Excel Data Analysis: Your Visual Blueprint for Analyzing Data, Charts and Pivot Tables", Wiley; Fourth edition 2013, ISBN-13 978-8126544004

**REFERENCE BOOK**

---

1. Gerard Jounghyun Kim, "Human-Computer Interaction: Fundamentals and Practice", CRC Press, Auerbach Publications, 1 edition, 2015 ISBN 9781482233896
2. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2013 ISBN-13: 978-1118430620  
978-8126544004

 <b>MIT</b>   Academy of Engineering (An autonomous Institute Affiliated to SPPU)	<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>	<b>W.E.F</b> <b>AY: 2017 - 2018</b>
<b>SECOND YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>	<b>COURSE NAME</b>	Materials Engineering
	<b>COURSE CODE</b>	ME201
	<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2017</b>	<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	50	20	Nil	25	125

**PRE-REQUISITE :** Physics, Chemistry

**COURSE OBJECTIVES :**

ME201.CEO.1: To select material for engineering application.  
 ME201.CEO.2: To classify the available materials.  
 ME201.CEO.3: To utilize available material for specified purpose.  
 ME201.CEO.4: To compare desired quality of materials from standard data.  
 ME201.CEO.5: To measure useful properties of materials.

**COURSE OUTCOMES :**

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

ME201.CO.1: Select material for engineering application.  
 ME201.CO.2: Classify the available materials.  
 ME201.CO.3: Utilize available material for specified purpose.  
 ME201.CO.4: Compare desired quality of materials from standard data.  
 ME201.CO.5: Measure useful properties of materials.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Ferrous, Nonferrous metals and alloys</b>	<b>8 HOURS</b>
Classifications and specifications of steels and cast iron. Heat treatment of steels, Defects due to heat treatment and remedial measures. Classification of surface hardening treatments. Classification, Composition, Properties & applications of: Copper and Its alloys, Nickel and Its alloys, Aluminum and Its alloys. Specific alloys: soldering & brazing alloy, Precipitation hardening alloys. Bearing materials and their applications.		
<b>UNIT 2</b>	<b>Engineering Polymers, Ceramics and Glass</b>	<b>6 HOURS</b>
Classification of polymers, Polymer types-thermoplastics-thermoset-Elastomers, Polymer synthesis and processing-injection moulding-extrusion-blow moulding-calendaring, Degradation of polymers-chemical, thermal, -biological-mechanical. Polymer recycling methods Introduction to Advanced Ceramics-Barium Titanate, Ferrites, Silicon Carbide, Alumina, Ceramics, its classifications and their applications, Introduction to Cermets and its application. HIGH PERFORMANCE POLYMERS:Acrylo Butadiene Styrene- Polycarbonate-Polyamide, Polymethyl Methacrylate: Characteristic, properties and evaluation		
<b>UNIT 3</b>	<b>Composite Materials</b>	<b>6 HOURS</b>
Need of composites. Particle-reinforced composites, large-particle composites, dispersion-strengthened composites. Fiber-reinforced composites, polymer-matrix composites, metal-matrix composites, ceramic-matrix composites, carbon-carbon composites, fiber-reinforced composites, structural composites, laminar composites.		
<b>UNIT 4</b>	<b>Electronic and Photonic materials</b>	<b>6 HOURS</b>
Electronic Materials: Intrinsic and extrinsic semiconductors-p-n junction, Bandgap diagrams for conductor, semiconductor and insulator, IR detectors, Hall effect Superconducting Materials: Normal and High temperature superconductivity, Applications. Photonic Materials: LED, LCD, Photo conducting materials, Photo detectors, Photonic crystals and applications. Advancements in electronic materials: Smart materials		
<b>UNIT 5</b>	<b>Testing of Engineering Materials</b>	<b>8 HOURS</b>
Need and Comparison of destructive and non-destructive tests, Study of destructive testing: Engineering stress-strain curve, true stress-strain curve, Jominy End Quench Test for hardenability, Izod and Charpy Impact Test. Vickers, Rockwell hardness tests. Non -Destructive Testing Non-Destructive testing: Principles & procedure, advantages, disadvantages and Industrial applications of NDT like Sonic & Ultrasonic testing and Radiography tests. Brief overview of another NDT test- Eddy current test, Magnetic Particle Test		
<b>UNIT 6</b>	<b>Nanomaterials.</b>	<b>6 HOURS</b>
Basic concepts of Nano science and Nanotechnology, Carbon nanotubes, Principle of SEM, TEM and AFM, X ray diffraction Fundamentals principles of SEM, SE and BSE imaging modes, Fracture mode analysis and failure analysis using SEM. Potential uses of nonmaterial's' in electronics, robotics, sports equipment, mobile electronic devices, Medical applications of nanomaterials-Cancer, AIDS treatment.		


<b>PRACTICAL: Perform the following experiments.</b>		
<b>PRACTICAL NO.01</b>	<b>Jominy End Quench Test</b>	<b>2 HOURS</b>
Jominy End Quench Test for hardenability.		
<b>PRACTICAL NO.02</b>	<b>Izod / Charpy Impact Test</b>	<b>2 HOURS</b>
Izod / Charpy Impact Test.		
<b>PRACTICAL NO.03</b>	<b>Hardness Test</b>	<b>4 HOURS</b>
Vickers,/ Rockwell, Brinell/Durometers & Poldi Hardness Test.		
<b>PRACTICAL NO.04</b>	<b>Magnetic Particle &amp; Dye Penetrant Test</b>	<b>4 HOURS</b>
Magnetic Particle & Dye Penetrant Test.		
<b>PRACTICAL NO.05</b>	<b>Ultra-sonic Test</b>	<b>4 HOURS</b>
Ultra sonic test for detection of flaws in materials.		
<b>PRACTICAL NO.06</b>	<b>Determination of Hall coefficient</b>	<b>4 HOURS</b>
Determination of Hall coefficient for a semiconducting material.		
<b>PRACTICAL NO.07</b>	<b>Soldering</b>	<b>4 HOURS</b>
Hard and Soft soldering using soldering materials.		
<b>PRACTICAL NO.08</b>	<b>Industrial Visit</b>	
Visit to advanced materials characterization laboratory.		

### **TEXT BOOK**

1. Material Science & Metallurgy for Engineers, Dr. V.D. Kodgire & S. V. Kodgire, Everest Publications.31st Edition, ISBN No: 8186314008
2. Mechanical Behavior & Testing of Materials, A. K. Bhargava, C.P. Sharma P H I Learning Private Ltd. 2011 edition, ISBN No 13-9788120342507

### **REFERENCE BOOK**

1. Engineering Metallurgy, Higgins R. A., Viva books Pvt. Ltd., 2004 ISBN No 13-9788176490276
2. Material Science & Engineering, Raghavan V., Prentice Hall of India, New Delhi. 2003 ISBN No 13-9788120324558
3. Introduction to Physical Metallurgy, Avner, S. H., Tata McGraw-Hill, 2014, ISBN 13-9780074630068
4. Materials Science & Engineering, W. Callister, Wiley Publications,2013, ISBN No 13-9788126521432
5. Physical Metallurgy for Engineers, Clarke D.S. & Varney W.R. Affiliated East-West Press, New Delhi ISBN No 13-978-8176710350

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2017-2018</b>
<b>SECOND YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Fluid Mechanics
		<b>COURSE CODE</b>	ME211
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2017</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	50	20	50	-	150

**PRE-REQUISITE :** Physics, Applied Mechanics

**COURSE OBJECTIVES :**

ME211.CEO.1: To recall properties and basic concepts of fluid mechanics.  
 ME211.CEO.2: To observe flow patterns and able to classify the flow.  
 ME211.CEO.3: To apply various fluid dynamic equations to flow field.  
 ME211.CEO.4: To analyze and minimize various losses in flow field.  
 ME211.CEO.5: To predict the behavior of flow field in real life.

**COURSE OUTCOMES :**

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

ME211.CO.1: Define the properties of fluids and different terms in fluid statics, kinematics and dynamics.  
 ME211.CO.2: Identify the pressure, velocity and discharge in any type of flow also able to visualize the flow.  
 ME211.CO.3: Calculate losses in flow field.  
 ME211.CO.4: Analyse when and which types of flow equations are applicable for the flow problems.  
 ME211.CO.5: Predict the type of flow and able to use fundamental equations in real life problems.



<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Fundamental Concepts and Fluid Statics</b>	<b>8 HOURS</b>
Fundamental Concepts: Continuum, fluid properties - density, pressure, viscosity, surface tension, compressibility. Classification of fluid. Fluid Statics: Definition of body forces and surface forces, static pressure, Pascal's law, Hydrostatic equation, Application to manometer, Forces on submerged surfaces, Buoyancy, stability and Archimedes' Principle.		
<b>UNIT 2</b>	<b>Fluid Kinematics</b>	<b>8 HOURS</b>
Description of flow field - Lagrangian and Eulerian approach, Acceleration, Classification of flow field, Fluid element's translation, rotation and deformation, Flow patterns streamlines, path lines and streak lines, Circulation, Vorticity, stream function, velocity potential function.		
<b>UNIT 3</b>	<b>Fluid Dynamics</b>	<b>7 HOURS</b>
Forces acting on fluid, Forces in Navier–Stokes and Reynolds equation, Euler's equation, Bernoulli's equation and its application, Fundamental equation of mass, momentum and energy. Hydraulic Coefficients. Flow through the orifice and notches.		
<b>UNIT 4</b>	<b>Flow Through Pipes and Head Losses</b>	<b>9 HOURS</b>
Reynolds Number and its significance in flow, Laminar flow through pipes and ducts, Turbulent flow through pipes, deriving velocity profile using NS equation and developing expression to compute other quantities-flow rate, pressure drop, shear stress, friction factor etc. Head losses- Major and Minor losses, HGL, TEL.		
<b>UNIT 5</b>	<b>External Flows and Dimensional Analysis</b>	<b>6 HOURS</b>
Fluid Instability, Boundary layer theory, Boundary layer thickness, flow separation, Flow over immersed bodies: Plate, Sphere, Cylinder and other objects, Concept of drag and lift. Aerofoil terminology. Introduction to dimensional analysis, Buckingham pi theorem, Dimensionless numbers		
<b>UNIT 6</b>	<b>Introduction to CFD</b>	<b>2 HOURS</b>
Introduction to CFD – Need, Applications, Numerical vs Analytical vs Experimental Solutions, Governing equation with convection, diffusion and source term.		

<b>PRACTICAL:</b>		
<b>PRACTICAL NO.01</b>	<b>Viscosity</b>	<b>2 HOURS</b>
Determination of viscosity of given oil and it's variation with respect to temperature		
<b>PRACTICAL NO.02</b>	<b>Bernoulli's</b>	<b>2 HOURS</b>
Verification of Bernoulli's equation.		
<b>PRACTICAL NO.03</b>	<b>Cd in Venturimeter/ Orificemeter</b>	<b>4 HOURS</b>
Calculate coefficient of discharge in Venturimeter/ orificemeter/rotameter.		
<b>PRACTICAL NO.04</b>	<b>Reynolds's experiment</b>	<b>2 HOURS</b>
Identification of type of flow using Reynolds's experiment		
<b>PRACTICAL NO.05</b>	<b>Major Losses</b>	<b>2 HOURS</b>
Determination of major losses in pipes		
<b>PRACTICAL NO.06</b>	<b>Minor Losses</b>	<b>2 HOURS</b>
Determination of minor losses in pipes		
<b>PRACTICAL NO.07</b>	<b>Metacentric Height</b>	<b>2 HOURS</b>
Calculate its Metacentric height of ship model		
<b>PRACTICAL NO.08</b>	<b>Heleshaw Apparatus</b>	<b>2 HOURS</b>
Visualization of flow by using Heleshaw apparatus		
<b>PRACTICAL NO.09</b>	<b>Velocity Profile in Pipe</b>	<b>4 HOURS</b>
Visualization of velocity profile (for laminar flow) in a pipe using CFD Technique		
<b>PRACTICAL NO.10</b>	<b>Mini Project</b>	<b>4 HOURS</b>
Project Based Learning (PBL) Practices.		
<b>PRACTICAL NO.11</b>	<b>Notch Experiment</b>	<b>2 HOURS</b>
Calibration of Notch		


### **TEXT BOOK**

1. Dr. R.K. Bansal, Fluid Mechanics, Laxmi Publication, 2017, ISBN No. 9788131808153
2. Dr. P.N. Modi, Dr. S. M. Seth, Fluid Mechanics and Hydraulic Machines, Standard book house, 2009, ISBN No. 78-8189401269
3. Frank M. White, Fluid Mechanics, McGraw Hill Publications, 2010, ISBN-13: 978-0077422417
4. Streeter and Wylie, Fluid Mechanics, McGraw Hill, ISBN-13: 978-0070622425
5. Munson, Fundamentals of Fluid Mechanics, Wiley, 2001, ISBN-13: 978-0471442509

## REFERENCE BOOK

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1. Kundu, Cohen, Dowling, Fluid Mechanics, Elsevier India, 2015, ISBN-13: 978-0124059351 9
2. Yunus Cengel, John Cimbala, Fluid Mechanics Fundamentals and Applications, McGraw Hill, ISBN-13:978-0-07-070034-5
3. Som, Biswas and Chakraborty, Introduction to fluid mechanics and fluid machines, McGraw Hill,2017, ISBN-13: 978-0071329194
4. FOX, McDONALD, PRITCHARD, Fluid Mechanics, Wiley publication,2015, ISBN No. 978-81-265-4128-7
5. John Anderson Jr. Computational Fluid Dynamics the basics with application, McGraw Hill, 2012, ISBN: 9781259025969

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>	<b>COURSE SYLLABI (2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2017-2018</b>
<b>SECOND YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Manufacturing Technology
		<b>COURSE CODE</b>	ME212
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2017</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	50	20	50	-	150

**PRE-REQUISITE :** Physics, Engineering Tools & Techniques

**COURSE OBJECTIVES :**

ME212.CEO.1: List different manufacturing machines and their processes.  
 ME212.CEO.2: Illustrate different manufacturing techniques.  
 ME212.CEO.3: Select proper metal cutting tools and machining parameters for manufacturing process.  
 ME212.CEO.4: Identify the CNC specifications and its uses in industries.  
 ME212.CEO.5: Compare different non-conventional machining processes.

**COURSE OUTCOMES :**

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


ME212.CO.1: Select appropriate manufacturing processes and machines for manufacturing a product.  
 ME212.CO.2: Demonstrate working of various machines.  
 ME212.CO.3: Make use of proper tooling and different machining parameters for manufacturing.  
 ME212.CO.4: Develop jigs and fixtures for specified product.  
 ME212.CO.5: Utilize the CNC Technology and non-conventional machining processes in industry.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Conventional Manufacturing Processes</b>	<b>8 HOURS</b>
<p><b>Material removing processes:</b> Turning, milling, drilling, boring and broaching. <b>Material Adding processes:</b> Casting, Welding, Soldering, and Brazing. <b>Material shaping processes:</b> Forging. <b>Material finishing processes:</b> Grinding, lapping and buffing.</p>		
<b>UNIT 2</b>	<b>Conventional Machines</b>	<b>8 HOURS</b>
<p><b>Material removing Machines:</b> Lathe, milling and drilling.  <b>Material Adding Machines:</b> Arc, TIG, MIG and Spot welding.  <b>Material shaping Machines:</b> Forging.  <b>Material finishing Machines:</b> Grinding, lapping and buffing.</p>		
<b>UNIT 3</b>	<b>Cutting Tools</b>	<b>6 HOURS</b>
<p><b>Single point tools:</b> Tool terminology, carbide, brazed and index able inserts.  <b>Drills, Milling tools:</b> Tool terminology, types, tool selection and applications.  <b>CNC Tools:</b> Modern cutting tools for CNC machines. Cutting tool materials.</p>		
<b>UNIT 4</b>	<b>Metal Cutting Technology</b>	<b>6 HOURS</b>
<p>Concept of speed, feed, depth of cut, cutting action, cutting forces. Tool dynamometry- Requirements, types and applications, Measurement of cutting forces. Power requirement, Machinability, tool life, Selection of coolants.</p>		
<b>UNIT 5</b>	<b>CNC Technology</b>	<b>6 HOURS</b>
<p>Introduction, CNC axes and drives. Automatic Tool and pallet Changer, Concept of a CNC Part Program and CNC support systems. Introduction and applications of Jigs and fixtures.</p>		
<b>UNIT 6</b>	<b>Non-conventional Machining Processes</b>	<b>6 HOURS</b>
<p>Importance &amp; scope of non-conventional machining processes: Electro-Discharge machining (EDM), Wire Electro-Discharge machining (WEDM), Abrasive Jet Machining (AJM), and Laser Beam Machining (LBM), Ultrasonic Machining (USM), Abrasive water Jet Machining (AWJM).</p>		

<b>PRACTICAL:</b>		
<b>PRACTICAL NO.01</b>	<b>Machining operations</b>	<b>10 HOURS</b>
To manufacture a product involving – operations on Lathe, Milling and Drilling Machines like facing, step turning, taper turning drilling, slotting & keyway making.		
<b>PRACTICAL NO.02</b>	<b>Machining time calculations</b>	<b>2 HOURS</b>
To calculate Machining Time for the component manufactured in Practical No.1		
<b>PRACTICAL NO.03</b>	<b>Welding operations</b>	<b>10 HOURS</b>
To manufacture product by welding joint using TIG or MIG or Arc welding, with its process sheet like Edge preparation, drilling, tapping, taper filling, etc Test.		
<b>PRACTICAL NO.04</b>	<b>Clamping techniques</b>	<b>2 HOURS</b>
To study clamping of the components with different clamping techniques.		
<b>PRACTICAL NO.05</b>	<b>Jigs and fixtures</b>	<b>4 HOURS</b>
Mini Project: To design a mini jig and fixture from wood for a given component.		
<b>PRACTICAL NO.06</b>	<b>CNC and part programming</b>	<b>2 HOURS</b>
Introduction to CNC Machine and Part Programming		
<b>PRACTICAL NO.07</b>	<b>Industrial Visit</b>	
Industrial visit.		

<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. S.K. Hajra Choudhary, A.K. Hajra Choudhary “Elements of Workshop Technology”, Media Promoters, 2010, ISBN No. 13: 978-8185099156</li> <li>2. D.K. Singh, “Fundamentals of Manufacturing Engineering”, CRC Press, 2008, ISBN No. 13: 978-1420070477</li> <li>3. P. N. Rao, “Manufacturing Technology: Foundry, Forming and Welding”, TMH, 2009</li> </ol>

<b>REFERENCE BOOK</b>
<ol style="list-style-type: none"> <li>1. B. Ravi, “Metal Casting Computer Aided design and analysis”, Prentice-Hall of India Pvt. Ltd, 2005, ISBN-13: 978-8120327269</li> <li>2. Alexandre Reikhar, “Casting: An analytical approach”, Springer, 2014, ISBN No ISBN-13: 978-1447159735</li> <li>3. Wailong Wang, “Rapid tooling guidelines for sand casting”, Springer, 2012, ASIN: B00I2JENU4</li> </ol>

 <b>MIT</b> (An Autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>		<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2017-2018</b>
<b>SECOND YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>		Psychology
		<b>COURSE CODE</b>		HP201
		<b>COURSE CREDITS</b>		2
<b>RELEASED DATE : 01/06/2017</b>		<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
2	-	20	40	15	NIL	NIL	75

**PRE-REQUISITE : NIL**

**COURSE OBJECTIVES :**

HP201.CEO.1: To introduce the basic concept and scope of Organizational Behavior.

HP201.CEO.2: To teach the theory of personality and its implications in the organization.

HP201.CEO.3: To evince types and styles of Leadership and the impact of values on the same.

HP201.CEO.4: To guide learners through a decision making process.

HP201.CEO.5: To enhance participants' skills when practicing team work concepts through business games.

HP201.CEO.6: To introduce the concept of Motivation and constructive ways of coping.

**COURSE OUTCOMES :**

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

HP201.CO.1: Explain human behavior in the workplace from an individual, group, and Organizational perspective.

HP201.CO.2: Develop an ability to analyze one's own personality and that of others in Organizations.

HP201.CO.3: Compare different leadership styles with an understanding of how core values affect Leadership.

HP201.CO.4: Demonstrate decision making ability

HP201.CO.5: Identify the problems associated with organizing and managing teams.

HP201.CO.6: Comprehend the correlation amongst stress, motivation and personality.

<b>THEORY</b>		
<b>UNIT 1</b>	<b>Organizational Behaviour</b>	<b>6 HOURS</b>
Meaning of Psychology and Organizational Behaviour, Psychology in Organization: History of Organizational Psychology; Scope and Research in Organizational Behaviour, Structure of Organization, Organizational culture, Strong vs Weak culture, Culture vs Formalization.		
<b>UNIT 2</b>	<b>Perception and Decision Making</b>	<b>6 HOURS</b>
Meaning, process and determinants of Perception, Process of Decision Making, The link between Perception and Individual Decision Making, Influences on Decision Making: Individual Differences & Organizational constraints, Process and ethics of decision making.		
<b>UNIT 3</b>	<b>Personality, Values and Leadership</b>	<b>6 HOURS</b>
What is Personality, The Big Five Personality Model, The importance of values; values and ethical behavior, Leadership, Understanding Personality, values and Leadership, Emotional Intelligence- Personal and Social Competence.		
<b>UNIT 4</b>	<b>Understanding Team Work and Conflict Resolution</b>	<b>6 HOURS</b>
Difference between groups and teams, Types of teams, Turning Individuals into Team players, Team building and Team based work, Team dynamics, Types of conflict and conflict resolution.		
<b>UNIT 5</b>	<b>Motivation &amp; Stress</b>	<b>4 HOURS</b>
Motivation and its types, Content and Process Theories of Motivation, Concept and reactions to stress, Potential effects of stress, Coping with and managing stress.		


<b>TEXT BOOK</b>		
<ol style="list-style-type: none"> <li>1. S. P. Robbins, "Organizational Behavior" Prentice-Hall India, 1995, ISBN-11:81-203-2875-2.</li> <li>2. F. Luthans," Organizational Behavior". McGraw-Hill, 1995, ISBN-13: 0072873876.</li> <li>3. U. Sekarn, "Organizational Behavior: Text and Cases", Tata McGraw Hill, 1996, ISBN: 0074603663.</li> <li>4. Furnham, "The Psychology of Behavior at Work", Psychology Press, 1997, ISBN: 1841695041 .</li> </ol>		



## REFERENCE BOOK

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1. M. D. Dunnett, "Handbook of Industrial-Organizational Psychology", Jaico Press, 1990, ISBN: 978089106-041-3.
2. M. A. - Ansari, "Managing people at work: Leadership styles and influence strategies", Sage, 1990, ISBN: 0803996500.
3. J. B. P. Sinha, "Work Culture in Indian Context", Sage, 1990, ISBN: 0019-5286.
4. D.M. Pestonjee, "Stress and Coping: The Indian Experience, 2nd ed.", Sage Publications, 1999, ISBN: 0761993126.
5. L. N. Jewell & M. Siegall, "Contemporary Industrial/Organizational Psychology", West Publishing Company, 1990, ISBN: 0314715991.
6. D. Katz and-R. L. Kahn, "The Social Psychology of Organizations", Wiley, 1966, ISBN: 978-0-471-023553.
7. M.L. Blum, and J.C. Naylor, "Industrial Psychology", CBS Publishers & Distributors, 1984, ISBN: 8123908601.
8. K. H. Blanchard and P. Hersey, "Management of Organizational Behavior: Utilizing Human Resources", Prentice-Hall India, 1993, ISBN: 0-13-5512868-9.

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY</b> <b>MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Minor Project
		<b>COURSE CODE</b>	ME213
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			PRACTICAL/ TUTORIAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
-	4	-	-	-	-	75	75

**PRE-REQUISITE :** Design Thinking, Engineering Tools & Techniques, Prototyping

**COURSE OBJECTIVES :**

- ME213.CEO.1: To identify and define a problem to be solved.  
 ME213.CEO.2: To develop a design for the solution of the problem using engineering tools available.  
 ME213.CEO.3: To prepare prototype/working model for solving the problem  
 ME213.CEO.4: To evaluate the model built for its functionality, reliability, sustainability, maintainability and affordability

**COURSE OUTCOMES :**

- The students after completion of the course will be able to,
- ME213.CO1: Define the problem to be solved.  
 ME213.CO2: Apply knowledge of various engineering tools to develop the solution to the problem.  
 ME213.CO3: Critically analyze the options available to solve the problem and select the one identified most effective.  
 ME213.CO4: Justify the selection of the method to solve the problem is-a-vis other options considered.  
 ME213.CO5: :Build the working model of the solution to solve the problem.

#### **PREAMBLE:**

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 minor project follows the same theme. The minor project aims to identify the problems from the society and develop the solutions for the same using science and technology for the betterment of society or human life.

#### **GUIDELINES:**

1. Every student shall undertake the Minor Project in semester IV.
2. Every student shall work on an approved project, a group of 03 students (maximum) shall be allotted for each minor project
3. The group members could be from different departments to support the interdisciplinary functioning
4. The students have to identify the social problem by discussion with various stakeholders, site visits and expert-opinions
5. Collect the sufficient data to establish the criticality of the problem to be solved.
6. Define the actual problem
7. Enumerate various approaches and solutions to solve the problem
8. Select and justify one of the solutions identified based on the feasibility, affordability and ease of use
9. Develop prototype or model for its testing before implementation
10. The three-member committee of jury members will be appointed to monitor the progress and continuous evaluation of each project. One of the members will be the project guide. Assessment of the project for award of grade shall be done jointly by the guide and committee of jury members

#### **TIMELINE**

1. Project group formation: 1 Week.
2. Identification of the problem to be solved: 2 Weeks.
3. Data collection to prove the validity of the problem: 2 Weeks
4. Identification of the various approaches to solve the problem: 2 weeks.
5. Justification of the approach selected to solve the problem: 1 week
6. Building the solution to the problem using prototype or implementation: 6 Weeks
7. Report writing: 2Weeks

#### **ASSESSMENT**

Presentation 1: Motivation and need for the selected problem to be solved

Presentation 2: To prove the validity of the problem to be solved using data collected

Presentation 3: Identified approaches to solve the problem and justification of approach selected

Presentation 4: Progress towards the prototyping or implementation of the solution to the problem

Presentation 5: Final demonstration



**MIT ACADEMY OF ENGINEERING, ALANDI**

**An Autonomous Institute Affiliated to**

**Savitribai Phule Pune University**

**Curriculum**

**For**

**Third Year**

**Bachelor of Technology in  
Mechanical Engineering**

**2016-2020**

**(With Effect from Academic Year: 2018-2019)**

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**SCHOOL OF MECHANICAL & CIVIL  
ENGINEERING**

**W. E. F : 2018-19**

**T Y B TECH**

**RELEASE DATE : 01/12/2017**

**DEPARTMENT OF MECHANICAL ENGG**

**REVISION NO. : 0.0**

**SEMESTER: V**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC5	ME301	Machine Design	3	2	4
2.	DC6	ME302	Machines & Mechanisms	3	2	4
3.	DC7	ME303	Heat Transfer	3	2	4
4.	OE1	ME31#	Open Elective - Refer Annexure.	3	2	4
5.	HSS5	HP302	Professional Skills	--	4	2
6.	SDP5	ME30#	Skill Development Lab - Refer Annexure	--	4	2
<b>TOTAL</b>				12	16	20


**SEMESTER:VI**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC8	ME321	Turbomachines	3	2	4
2.	DC9	ME322	Quality Assurance	3	2	4
3.	DC10	ME323	Operations Research	3	2	4
4.	OE2	ME33#	Open Elective - Refer Annexure.	3	2	4
5.	HSS6	HP303	Basics of Entrepreneurship	--	2	1
6.	HSS4	HP301	Project Management	1	2	2
7.	SDP6	ME324	Mini Project	--	4	2
<b>TOTAL</b>				13	16	21

*L: Lecture, P: Practical*

<b>Open Elective (OE): 4 Courses</b>			
	<b>Sl. No.</b>	<b>Course Code</b>	<b>Name of Course</b>
Computer Aided Engineering	1.	ME311	Geometric Modeling & Design
	2.	ME331	Finite Element Analysis
	3.	ME421	Computational Fluid Dynamics
	4.	ME451	Advanced Engineering Analysis
Robotics & Automation	1.	ME312	Fundamentals of Robotics
	2.	ME332	Kinematics & Dynamics of Robots
	3.	ME422	Robotics Vision and Control
	4.	ME452	Intelligent and High Performance Robotics
Industrial Engineering & Management	1.	ME313	Work Process Assessment
	2.	ME333	Facility Planning & Design
	3.	ME423	Operations Management
	4.	ME452	Supply Chain Management

<b>Skill Development and Project (SDP): 10 Courses</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Name of Course</b>
1.	ME102	Engineering Tools and Techniques
2.	ME103	Design Thinking
3.	ET206	Prototyping
4.	ME213	Minor Project
5.	ME304	Skill Development Lab (Autodesk Inventor)
	ME305	Skill Development Lab (CATIA)
6.	ME403	Piping Design
	ME404	Six Sigma
	ME405	Energy Audit
7.	ME324	Mini Project
8.	ME402	Project - I
9.	ME406	Summer Internship
10.	ME432	Project - II

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Machine Design
		<b>COURSE CODE</b>	ME301
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	25	25	150

**PRE-REQUISITE :** Design Thinking, Solid Mechanics

**COURSE OBJECTIVES :**

ME301.CEO.1: To Select design procedure and Design parameters for machine Elements  
 ME301.CEO.2: To make use of different design standards.  
 ME301.CEO.3: To interpret different types of failure modes and criteria.  
 ME301.CEO.4: To illustrate design of different types of machine elements.  
 ME301.CEO.5: To develop teamwork, critical thinking and planning through design project.

**COURSE OUTCOMES :**

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

ME301.CO.1: Recall fundamental Design procedure and Design parameters for machine Elements.  
 ME301.CO.2: Illustrate Design Procedure of the Machine Elements considering failure criterias.  
 ME301.CO.3: Identify the various stresses induced in a machine elements for safer dimensions.  
 ME301.CO.4: Examine the stresses induced in machine elements for various failure modes.  
 ME301.CO.5: Determine the optimum and reliable solutions for the Mechanical Engineering problems based on required criteria's.


<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Fundamentals of Machine Design</b>	<b>8 HOURS</b>
Introduction to Machine Design, Design Process Cycle, Design Considerations. Standards and Codes, Preferred Series, Ethics in design. Design for safety and reliability- Factor of safety, Service Factor. Design of Simple Machine Elements– Cotter joints, Knuckle joint.		
<b>UNIT 2</b>	<b>Shafts, Keys &amp; Couplings</b>	<b>6 HOURS</b>
Design of Shafts on the basis of Strength, Torsional Rigidity And Lateral Rigidity. ASME Codes for shaft design. Types of keys and their design, Coupling.		
<b>UNIT 3</b>	<b>Design Against Fluctuating Load</b>	<b>6 HOURS</b>
Stress Concentration – Causes and remedies, fluctuating stresses, fatigue failure, S-N curve, Endurance, Notch Sensitivity, Endurance Strength Modifying Factors, Design For Finite And Infinite life, Cumulative Damage In Fatigue Failure, Soderberg , Gerber ,Goodman, Modified Goodman diagrams, Fatigue Design under combined stresses.		
<b>UNIT 4</b>	<b>Design of Spur and Helical Gears</b>	<b>10 HOURS</b>
Spur Gears: Terminology, Force Analysis, Gear Tooth failures, Beam Strength (Lewis Equation) ,Wear Strength, Design of Spur Gears. Helical Gears: Terminology, Force Analysis, Virtual number of teeth, Beam Strength, Wear Strength, Design of helical Gears.		
<b>UNIT 5</b>	<b>Design of Bevel and Worm Gears</b>	<b>8 HOURS</b>
Bevel Gear : Terminology, Force Analysis, Virtual number of teeth, Design of Bevel Gears. Worm Gear: Terminology, Force Analysis, Design of Worm and Worm Gears using thermal considerations.		
<b>UNIT 6</b>	<b>Rolling Contact Bearings</b>	<b>6 HOURS</b>
Classification, Static And Dynamic Load Carrying Capacities, Stribeck Equation, Load-Life Relationship, Selection of Bearing life, Selection of Rolling Contact Bearing From Manufacture’s Catalogue, Bearing with probability of survival other than 90%. Mounting of Bearings , Preloading of bearings, Failures in Bearings- causes and remedies. Sliding Contact Bearings: Comparison Of Sliding Contact And Rolling Contact Bearings, Working Principle of Hydrodynamic and Hydrostatic Bearing.(Theoretical Treatment)		



<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>	<b>Presentations Based On Case Studies</b>	<b>12 HOURS</b>
<p>PPT Presentation / Poster Presentation based on real life application design problem.(Case Studies). Minimum 4 students are required to prepare a group and present the case studies. The presentation shall include Design Problem Area, Role of a specific machine element in the mechanical system, Identification of problem or failure modes, Approach/methodology to solve problem ,Necessary changes made in design parameters required to get the solution.</p>		
<b>PRACTICAL NO.02</b>	<b>Design Project Of a Two Speed Gearbox</b>	<b>16 HOURS</b>
<p>Introduction to Conventional Drawing, Manufacturing Tolerances, Geometric Dimensioning and Tolerances.</p> <p>Design of 2 Stage single speed Gearbox. It should consist of design of combination of two same or two different kind of gear pairs. Open ended problem statement related to current mechanical engineering applications is given to students or identified by students.</p> <p>Each project shall consist Of Two Full Imperical Size Sheets-one involving assembly drawing with part list and overall dimensions and other involving the detailed drawing of individual components. Manufacturing tolerances ,Surface finish symbols and geometric tolerances should be specified so as to make it a working drawing.</p> <p>A design report giving all necessary calculations of design of components and assembly should be separately submitted in the form of a file.Design data book should be used wherever necessary.</p> <p>The drawings shall be completed by drawing and drafting softwares. Oral will be based on the Design Projects, Design report and the syllabus.</p>		

<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. Bhandari V. B., Design of Machine Elements, Tata McGraw Hill, 1994. ISBN 13: 9780070681798.</li> <li>2. P.S. G. Design Data book (PSG College of Engg. &amp; Tech.), DPV Printers, Coimbatore, 2002. 6 Norton, R. L., Machine Design: An Integrated Approach, 3/e, Pearson, 2004.</li> <li>3. Shigley, J.E and Mischke, C. R. Mechanical Engineering Design, 6/e, Tata McGraw Hill, 2005. ISBN-13: 978-0071002929.</li> </ol>

<b>REFERENCE BOOK</b>
<ol style="list-style-type: none"> <li>1. Machine elements in Mechanical Design by R.L. Mott, Prentice Hall. ISBN: 0130618853, 9780130618856</li> <li>2. Mechanical Design by P. Childs, Elsevier. ISBN: 9780080886862</li> <li>3. Fundamentals of Machine Component Design by R. C. Juvinall &amp; K. M. Marshek, Wiley. ISBN-13: 978-1118012895</li> <li>4. Machine Design by R.L. Norton. ISBN: 0-13-148190-8</li> <li>5. B.J. Hamrock, and S.R. Schmid, Fundamentals of Machine Elements, Tata McGraw Hill, New Delhi, 2005. ISBN-13: 978-1482247480</li> </ol>

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Machines and Mechanisms
		<b>COURSE CODE</b>	ME302
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	25	25	150

**PRE-REQUISITE :** Engineering Graphics, Solid Mechanics

**COURSE OBJECTIVES :**

ME302.CEO.1: To learn Kinematics of Different Mechanisms and Machines.  
 ME302.CEO.2: To select Suitable Mechanism for Applications.  
 ME302.CEO.3: To categorize machine parts with their constructional and working features.  
 ME302.CEO.4: To learn all types of Gears and their Applications.  
 ME302.CEO.5: To develop competency in Drawing cam Profile

**COURSE OUTCOMES :**

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

ME302.CO.1: Outline the design problem and solve it.  
 ME302.CO.2: Enlist principles of kinematic pairs, chains and their classification.  
 ME302.CO.3: Analyze the planar mechanisms for position, velocity and acceleration.  
 ME302.CO.4: Interpret Constructional features and working features of parts of machines.  
 ME302.CO.5: Evaluate gear tooth geometry and select appropriate gears for the required applications.  
 ME302.CO.6: Design cams and followers for specified motion profile

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction to Mechanisms</b>	<b>6 HOURS</b>
Links, pair, kinematic chain, mechanism. Degrees of freedom. Four link mechanisms. Slider-crank mechanism. Mobility and range of movement.		
<b>UNIT 2</b>	<b>Kinematic analysis of plane mechanism</b>	<b>6 HOURS</b>
Displacement analysis. Instantaneous center of velocity. Kennedy theorem. Velocity analysis by graphical method. Acceleration analysis by graphical method. Coriolis component. Klein's construction.		
<b>UNIT 3</b>	<b>Force and motion analysis</b>	<b>6 HOURS</b>
D' Alembert's principle, Dynamic Force analysis by graphical method, Dynamic motion analysis, Friction, Turning moment diagram, Flywheel analysis.		
<b>UNIT 4</b>	<b>Cams and followers</b>	<b>6 HOURS</b>
Classification of cams. Classification of followers. Terminology. Motions of followers. Construction of Cam profiles. Cam jump phenomenon. Spatial cam follower mechanism.		
<b>UNIT 5</b>	<b>Gears</b>	<b>8 HOURS</b>
Classification of gears, Terminology of gears, Fundamental law of gearing, Interference and undercutting, Helical gears, Virtual number of teeth, Center distance of helical gears, Efficiency of helical gears, Spiral gears, Worm and worm wheel.		
<b>UNIT 6</b>	<b>Gyroscope and Governors</b>	<b>8 HOURS</b>
Gyroscopic torque, Gyroscopic effect in 2W vehicles, 4W vehicles, Airplanes, Naval ships, Porter governor, Proell governor, Hartung governor, Hartnell governor, Inertia governor.		


<b>PRACTICAL: Perform the following experiments.</b>		
<b>PRACTICAL NO.01</b>	<b>Prototype creation</b>	<b>4 HOURS</b>
To Create Prototype of any inversion of Slider Crank Mechanism		
<b>PRACTICAL NO.02</b>	<b>Velocity and Acceleration Analysis of Slider Crank Mechanism</b>	<b>6 HOURS</b>
Computer Program for Velocity and Acceleration Analysis of Slider Crank Mechanism		
<b>PRACTICAL NO.03</b>	<b>Cam Follower Mechanism</b>	<b>4 HOURS</b>
To Create Animation of Cam Follower Mechanism for a given Motion of Cam		
<b>PRACTICAL NO.04</b>	<b>Epicyclic gear trains</b>	<b>2 HOURS</b>
Torque analysis of Epicyclic gear trains		
<b>PRACTICAL NO.05</b>	<b>Study of Different Types of Gearboxes</b>	<b>2 HOURS</b>
Study of Different Types of Gearboxes and Their Applications		
<b>PRACTICAL NO.06</b>	<b>Gyroscopic couple of Uniform disc</b>	<b>2 HOURS</b>
Determination of Gyroscopic couple of Uniform disc		
<b>PRACTICAL NO.07</b>	<b>Governor</b>	<b>2 HOURS</b>
Experiment on Governor		
<b>PRACTICAL NO.08</b>	<b>Flywheel</b>	<b>2 HOURS</b>
To determine moment of inertia of a flywheel		

### **TEXT BOOK**

1. S. S. Rattan, Theory of Machines, McGraw Hill Publications. ISBN:13: 978-9351343479
2. Thomas Bevan, The Theory of Machines, Pearson Publications. ISBN: 9788131729656
3. A. G. Ambekar, Mechanism and Machine Theory, PHI. ISBN: 9788120331341
4. N. K. Mehta, Machine Tool Design and Numerical Control, Tata McGraw Hill Publication. ISBN: 13: 978-125900457
5. John Uicker, Joseph Shigley, Theory of Machines and Mechanisms, Oxford University Press. ISBN: 9780190264482

### **REFERENCE BOOK**

1. R L Norton, Kinematics and Dynamics of Machinery, McGraw-Hill. ISBN-13: 978-9351340201
2. Kenneth J Waldron, Gary L Kinzel, Kinematics, Dynamics and Design of Machinery, Wiley. ISBN: 978-1-118-93328-2
3. Meriam, J L and Kraige, L G, Engineering Mechanics: Dynamics, Wiley. ISBN: 9780471429173
4. D.K. Pal, S.K. Basu, Design of Machine Tools, Oxford & Ibh Publishing Co Pvt. Ltd. ISBN-13: 9788120417779
5. C. S. Sharma & Kamlesh Purohit, Theory of Machine and Mechanism, PHI, ISBN 9788120329010

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Heat Transfer
		<b>COURSE CODE</b>	ME303
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	30	20	150

**PRE-REQUISITE :** Thermal Engineering, Fluid Mechanics

**COURSE OBJECTIVES :**

ME303.CEO.1: To Recall modes of heat transfer and their applications.  
 ME303.CEO.2: To relate the heat transfer phenomenon of different thermal system.  
 ME303.CEO.3: To Calculate rate of heat transfer in real life applications.  
 ME303.CEO.4: To analyze the heat transfer in complex thermal systems.  
 ME303.CEO.5: To suggest suitable Heat Exchanger for any practical application.

**COURSE OUTCOMES :**

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

ME303.CO.1: Outline the design problem and solve it.  
 ME303.CO.2: Define the important modes of heat transfer and state their applications.  
 ME303.CO.3: Compare the heat transfer rate of different thermal system.  
 ME303.CO.4: Calculate heat transfer by conduction, convection and thermal radiation for practical situations.  
 ME303.CO.5: Analyze heat transfer in complex systems involving several heat transfer mechanisms.  
 ME303.CO.6: Recommend suitable Heat Exchanger for any practical application.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction to Heat Transfer</b>	<b>6 HOURS</b>
<p>Modes/laws of heat transfer, Thermal Conductivity, Electrical Analogy in conduction, derivation of Generalized heat conduction equation in Cartesian coordinates. Its reduction to Fourier, Laplace and Poisson's equation. Thermal diffusivity, Generalized heat conduction equation in cylindrical and spherical co-ordinates.</p>		
<b>UNIT 2</b>	<b>One Dimensional Steady State Heat Conduction</b>	<b>8 HOURS</b>
<p>Heat conduction through a plane wall, cylindrical wall and sphere. Heat conduction through a composite slab, cylinder and sphere, effect of variable thermal conductivity, critical radius of insulation, Economic insulation, and thermal contact resistance. One dimensional steady state heat conduction with heat generation for plane wall, cylinder and sphere</p>		
<b>UNIT 3</b>	<b>Extended Surfaces and Unsteady State Heat Conduction</b>	<b>8 HOURS</b>
<p>Types and Applications of Fins. Heat transfer through Extended surfaces, derivation of equations for temperature distribution and heat transfer through fins of constant cross-section area. Effectiveness and efficiency of a fin. Errors in the measurement of temperature in a thermo-well. Unsteady state heat conduction: System with negligible internal resistance, Biot and Fourier numbers. Lumped heat capacity method. Time constant and response of thermocouple, Transient heat analysis using charts. Thermal Insulation – Types and selection, Economic and cost considerations, Payback period.</p>		
<b>UNIT 4</b>	<b>Convection</b>	<b>6 HOURS</b>
<p>Introduction to Convection: Local and average convective coefficient. Hydrodynamic and thermal boundary layer. Laminar and turbulent flow over a flat plate and in a pipe. Free and Forced Convection: Physical significance of the dimensionless numbers related to free and forced convection. Empirical correlations for convective heat transfer. Introduction to Condensation and Boiling: Modes of pool boiling, critical heat flux, burnout point, forced boiling. Film and drop wise condensation.</p>		
<b>UNIT 5</b>	<b>Radiation</b>	<b>6 HOURS</b>
<p>Concept of Black Body, Fundamental Laws of Radiation, Radiative properties of a surface, Radiation shape factor, use of shape factor charts, Heat exchange between non-black bodies, . Electrical Analogy for radiation heat exchange, heat exchange between two infinitely parallel planes, cylinders and spheres, Radiation shields.</p>		
<b>UNIT 6</b>	<b>Heat Exchangers</b>	<b>8 HOURS</b>
<p>Heat exchangers classification, overall heat transfer coefficient, heat exchanger analysis- use of log mean temperature difference (LMTD) for parallel and counter flow heat exchangers. LMTD correction factor, fouling factor. The effectiveness-NTU method for parallel and counter flow heat exchangers. Design considerations of heat exchanger, compact heat exchangers.</p>		

<b>PRACTICAL: Perform the following experiments.</b>		
<b>PRACTICAL NO.01</b>		<b>4 HOURS</b>
Determination of thermal conductivity of insulating powder.		
<b>PRACTICAL NO.02</b>		<b>4 HOURS</b>
Determination of Thermal Conductivity of Composite wall.		
<b>PRACTICAL NO.03</b>		<b>2 HOURS</b>
Determination of temperature distribution, fin efficiency in Natural Convection.		
<b>PRACTICAL NO.04</b>		<b>2 HOURS</b>
Determination of heat Transfer Coefficient in Natural Convection from Cylinder.		
<b>PRACTICAL NO.05</b>		<b>2 HOURS</b>
Determination of heat Transfer Coefficient in Forced Convection from Cylinder.		
<b>PRACTICAL NO.06</b>		<b>4 HOURS</b>
Determination of Critical Heat Flux.		
<b>PRACTICAL NO.07</b>		<b>2 HOURS</b>
Determination of Stefan Boltzmann Constant.		
<b>PRACTICAL NO.08</b>		<b>4 HOURS</b>
Determination of emissivity of given surface.		
<b>PRACTICAL NO.09</b>		<b>4 HOURS</b>
Determination of effectiveness of Heat Exchanger.		

### **TEXT BOOK**


1. Y.A. Cengel and A.J. Ghajar, Heat and Mass Transfer – Fundamentals and Applications, Tata McGraw Hill Education Private Limited. ISBN-13: 978-0073398181
2. S.P. Sukhatme, A Textbook on Heat Transfer, Universities Press. ISBN: 9788173715440
3. A.F. Mills, Basic Heat and Mass Transfer, Pearson. ISBN-13: 978-1292042480
4. B.K. Dutta, Heat Transfer-Principles and Applications, PHI. ISBN-13: 978-8120316256

## REFERENCE BOOK

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1. S.P. Venkatesan, Heat Transfer, Ane Books Pvt. Ltd.M. S. Jamil Asgar, "POWER ELECTRONICS", PHI Learning Private Limited-New Delhi; 1 Edition edition, 2004, ISBN: 978-8120323964
2. Holman, Fundamentals of Heat and Mass Transfer, McGraw – Hill publication. ISBN-13: 978-0078447860
3. P. K. Nag, Heat & Mass Transfer, McGraw Hill Education Private Limited. ISBN-13: 978-0070702530
4. M. Thirumaleshwar, Fundamentals of Heat and Mass Transfer, Pearson Education India. ISBN: 8177585193, 9788177585193
5. R. C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New Age Science. ISBN-13: 978-8122427851.



 <b>MIT</b> (An Autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>			<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>			<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY</b>			<b>COURSE NAME</b>		Project Management
			<b>COURSE CODE</b>		HP 301
			<b>COURSE CREDITS</b>		2
<b>RELEASED DATE : 01/06/2018</b>			<b>REVISION NO</b>		0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
1	2	15	25	10	NIL	25	75

**PRE-REQUISITE : NIL**

**COURSE OBJECTIVES :**

HP301.CEO.1: To introduce the basic concept and scope of Project Management.

HP301.CEO.2: To teach the theory of project Initiation and its analysis with project vision.

HP301.CEO.3: To introduce the concept of risk analysis and different types of tools used in project planning.

HP301.CEO.4: To guide learners monitoring and controlling project progress.

HP301.CEO.5: To introduce the concept of System dynamics, project audit and reviews.

**COURSE OUTCOMES :**

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

HP301.CO.1: Explain the concept of project management.

HP301.CO.2: Develop an ability to analyze scope, objective and vision of project initiation.

HP301.CO.3: Able to analyze risk and different tools of project planning.

HP301.CO.4: Develop an ability to measure progress of project by monitoring and controlling

HP301.CO.5: Identify the problems associated with project and reviewing the same.

<b>THEORY</b>		
<b>UNIT 1</b>	<b>Introduction Project Management</b>	<b>5 HOURS</b>
Meaning of Project Management, Classifications of projects, The Triple Constraint, The PMBOK project management process framework, Standard project team roles and project organisation (Functional, matrix, projectised), System approach, Systems development, System analysis, Project feasibility, Product life cycle, Project appraisal, Project contracting, The phases of SDLC.		
<b>UNIT 2</b>	<b>Project Initiation</b>	<b>5 HOURS</b>
Determining the project business reason, creating a project charter (market and technical analysis), financial analysis evaluation of project proposals, risk analysis, sensitivity analysis and social cost benefits analysis, defining scope and objectives, define a project vision.		
<b>UNIT 3</b>	<b>Project Planning</b>	<b>6 HOURS</b>
Planning fundamentals, identifying the project team responsibilities, project master plan, work breakdown structure, and other tools of project planning, estimating the efforts and duration of tasks, Identifying and analyzing risks, PERT, CPM, GERT, SLAM, DPM and resource allocation.		
<b>UNIT 4</b>	<b>Project monitoring and controlling</b>	<b>4 HOURS</b>
Executing the project on time, Measuring project progress, Identifying corrective actions, Internal & external project control, control process, variance limit, issues in project control.		
<b>UNIT 5</b>	<b>Project Learning</b>	<b>4 HOURS</b>
System dynamics, Project audit, Change management, Project reviews and reporting.		

<b>PRACTICALS</b>		
<b>PRACTICAL NO.01</b>	<b>SDLC</b>	<b>2 HOURS</b>
Preparing for managing and developing a perfect model of SDLC for a particular given problem.		
<b>PRACTICAL NO.02</b>	<b>PERT and CPM</b>	<b>2 HOURS</b>
Planning a project under PERT and CPM charts		
<b>PRACTICAL NO.03</b>	<b>GERT and SLAM</b>	<b>2 HOURS</b>
Planning a project under GERT and SLAM charts		
<b>PRACTICAL NO.04</b>	<b>DPM</b>	<b>2 HOURS</b>
Solving practical problems under DPM		


<b>PRACTICAL NO.05</b>	<b>Variance Limit</b>	<b>2 HOURS</b>
Project monitoring under variance and controlling according to the given situations.		
<b>PRACTICAL NO.06</b>	<b>System Dynamics</b>	<b>2 HOURS</b>
Understanding System dynamics by solving case studies		
<b>PRACTICAL NO.07</b>	<b>Change Management</b>	<b>2 HOURS</b>
Solving case studies for learning how change management works.		
<b>PRACTICAL NO.08</b>	<b>Project Reviewing</b>	<b>2 HOURS</b>
Solving many practical problems by reviewing projects as well as some case studies.		

### **TEXT BOOK**

1. James P. Clements and Gido, "Effective Project Management" Cengage India 5th Edition , ISBN: 9781111824051
2. John Nicholas, "Project Management for Business and Technology: Principles and Practice", PHI- Eastern economy 3rd Edition, ISBN: 0-7506-7824-0
3. Juana Clark Craig, "Project Management Lite", 2nd Edition, ISBN-13: 9781478129226
4. Harold R. Kerzner, "Project Management", 11th Edition, ISBN: 978-1-118-48322-0

### **REFERENCE BOOK**

1. Erik Larson and Clifford Gray, "Project Management: The Managerial Process", McGraw Hill ISBN-10: 0-07-340334-2
2. Enzo Frigneti, " The Practice of Project Management", KOGAN PAGE INDIA PRIVATE LIMITED, ISBN: 9788175545397
3. Geogary M. Horine, "Project Management", QUE 4th Edition, ISBN: 9780134653914
4. Cynthia Stackpole Snyder, "A User manual to The PMBOK Guide", ISBN: 9781118546604
5. Brown, James T., "The Handbook of Program Management: How to Facilitate Project Success with Optimal Program Management", Second Edition. The McGraw-Hill Companies, 2014, ISBN 978-0071837859
6. Frame, J. Davidson," Managing Projects in Organizations: How to Make the Best Use of Time, Techniques, and People", 3rd edition, Jossey-Bass, 2003, ISBN 0-787-96831-5
7. Kerzner, Harold," ProjectManagement: Project Management: A Systems Approach to Planning, Scheduling, and Controlling", 10th edition, Wiley, 2009, ISBN 0-470-27870-6
8. Meredith, R. Jack and Mantel, Jr., Samuel J., "Project Management: A Managerial Approach", 7th edition, Wiley, 2008, ISBN 0-470-22621-8
9. Stackpole, Cynthia Snyder, "A Project Manager's Book of Forms: A Companion to the PMBOK® Guide", Wiley, 2009, ISBN 978-0470389843
10. Weiss, Joseph and Wysocki, Robert," Five-phase Project Management: A Practical Planning And Implementation Guide", Basic Books, 1992, ISBN 0-201-56316-9

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Geometric Modeling and Design
		<b>COURSE CODE</b>	ME311
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	25	25	150

**PRE-REQUISITE :** Engineering Graphics, Applied Mathematics

**COURSE OBJECTIVES :**

ME311.CEO.1: To introduce the basic tools of computer-aided design (CAD) and computer graphics.  
 ME311.CEO.2: To expose contemporary computer design tools.  
 ME311.CEO.3: To prepare the student to be an effective user of a CAD system.  
 ME311.CEO.4: Explain vehicle suspensions and Safety Systems.  
 ME311.CEO.5: To impart the knowledge to develop design capabilities for 2D and 3D objects

**COURSE OUTCOMES :**

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

ME311.CO.1: Recall fundamentals of Computer Graphics.  
 ME311.CO.2: Explain Computer Graphics and the role of computer-aided design (CAD) in product development  
 ME311.CO.3: Illustrate the concepts of geometric and modelling techniques.  
 ME311.CO.4: Apply the knowledge to develop visualization of image display.  
 ME311.CO.5: Evaluate the modeling, drafting, detailing of 2D and 3D models.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction to GMD</b>	<b>6 HOURS</b>
Definitions and need of CAD, CAM and CAE, PLM A) Graphics System Types of systems, Input/output devices, Video display devices, Raster scan display, Random scan, Workstations and peripherals, graphics standards, Evaluation of CAD/CAM system. B) Geometric Modeling Types and parametric representation of lines & curves: DDA – Algorithm, Algorithms for line and circle		
<b>UNIT 2</b>	<b>Geometric Transformations</b>	<b>8 HOURS</b>
2-D Transformations, Composite Transformations, Introduction of 3-D transformations, Definitions of Projections, Viewing and clipping, Windowing, Segmentation, Trimming, Integration.		
<b>UNIT 3</b>	<b>Wire Frame Modeling</b>	<b>6 HOURS</b>
Introduction, Classification of wire frame entities, parametric representation of Analytic curves – lines, Circles, Ellipse, Conics, Parametric representation, Characteristics of Synthetic curves –Hermite cubic curves, Bezier curves, B-Splines curves.		
<b>UNIT 4</b>	<b>Surface Modeling</b>	<b>6 HOURS</b>
Introduction, features of Geometric Modeling, Surface entities, Surface representation Methods, parametric representation of surfaces, plane surface, ruled surface, surface of revolution, Tabulated surface. Hermite cubic surface, Bezier Surface, B spline surface.		
<b>UNIT 5</b>	<b>Solid Modeling</b>	<b>8 HOURS</b>
Introduction, Geometry and topology, Solid representation, Boundary representation (B-rep), Constructive solid geometry (CSG), Sweeping, Solid Manipulations.		
<b>UNIT 6</b>	<b>Advanced Modeling</b>	<b>6 HOURS</b>
Feature Based Modeling, Assembly Modeling, Introduction of Behavioral Modeling, Conceptual Design and Top-down Design. Techniques for visual realism - hidden line - Surface removal, Geometric Dimensioning & tolerances, Geometric and Dimensional Constraints.		

<b>PRACTICAL: Perform practicals using any CAD software package</b>		
<b>PRACTICAL NO.01</b>	<b>Modeling Using ANSYS Design Modeler</b>	<b>4 HOURS</b>
Use ANSYS Design Modeler to draw geometry of any machine component.		
<b>PRACTICAL NO.02</b>	<b>Part Modeling</b>	<b>4 HOURS</b>
Solid Modeling Using CATIA		
<b>PRACTICAL NO.03</b>		<b>2 HOURS</b>
Use following algorithm to rasterize line, circle a. DDA algorithm b. Bresenham's Circle Algorithm		
<b>PRACTICAL NO.04</b>		<b>2 HOURS</b>
Use following transformations and solve for the given input figure/coordinates. (Composite transformation) a. Rotate through $\theta$ . c. Scaling b. Translation d. Reflection		
<b>PRACTICAL NO.05</b>	<b>Surface Modeling</b>	<b>4 HOURS</b>
Surface Modeling using CATIA		
<b>PRACTICAL NO.06</b>	<b>Assembly Modeling</b>	<b>4 HOURS</b>
Assembly of any one machine component like knuckle joint, coupling, gate valve, stop valve, Bench vice, etc.		
<b>PRACTICAL NO.07</b>	<b>Detailing</b>	<b>2 HOURS</b>
Detailing of any one assembly and parts made in assignment 6 (Draw detail views with symbols, tolerances, surface finish factors and BOM)		


### **TEXT BOOK**

1. AutoCAD 2017(R1):3D Drawing & Modeling Autodesk Authorized Publisher ISBN- 978-1943184262
2. Paul Tigwell, Paul Carman CATIA reference guide onward press 2nd revised edition, ISBN-10:1566901553, ISBN-13- 978-1566901550
3. Computer Graphics, Hearn and Baker, Published by Dorling Kindersley Pvt. Ltd., 2nd Edition
4. C.R Alavala, CAD/CAM-Concepts and Applications, Prentice-Hall of India, 2008, ISBN-978-81-203-3340-6
5. Kuldeep Sareen- CAD/CAM-Theory & Concepts, S. Chand, ISBN: 9788121928748

## REFERENCE BOOK

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1. Ibrahim Zeid, CAD/CAM-Theory and Practice-McGraw Hill, 2006. ISBN:0070728577, ISBN-13-978-0070728578
2. Martenson, E. Micheal, Geometric Modelling, John Wiley & Sons, 1995-ISBN-9780831132989
3. P.N.Rao, CAD/CAM Principles and Applications, Mc Graw Hill Education. ISBN-13: 978-0070681934
4. Principles of Interactive Computer Graphics, Newmanand Sproull, Mc Graw Hill Education ISBN-0070463387
5. D. Hearn and M.P. Baker, Computer Graphics with OpenGL Version, (3rd edition), Pearson Education, 2004.ISBN-9788177587654

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Fundamentals of Robotics
		<b>COURSE CODE</b>	ME312
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	-	50	150

**PRE-REQUISITE :** Electrical & Electronics Engineering, Design Thinking

**COURSE OBJECTIVES :**

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ME312.CEO.1: To identify & classify the robots.  
 ME312.CEO.2: To describe different types of sensors and actuators.  
 ME312.CEO.3: To analyze different transmission system used in robot.  
 ME312.CEO.4: To Create Mechatronic system with sensing actuation system.

**COURSE OUTCOMES :**

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

ME312.CO.1: Identify key components of robots.  
 ME312.CO.2: Summarize classification, sensors and actuators of industrial robots.  
 ME312.CO.3: Develop different transmission system used in robotics.  
 ME312.CO.4: Create a robot with sensor/Actuator.



<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction of Robotics</b>	<b>6 HOURS</b>
Introduction, History, Specifications of Robots, Usage of Robots. Classifications of robots by– Application, by Coordinate system, By Actuation system, By Control method, By Programming Method, Work envelope - Flexible automation versus Robotic technology. Application: Manufacturing robots, Three axis KUKA Robot.		
<b>UNIT 2</b>	<b>Sensor and Actuators</b>	<b>8 HOURS</b>
Sensor classification, Internal Sensors, External Sensors, Sensor Selections., Actuators – Pneumatic, hydraulic, electric (servo motor, stepper motor), Selection of motors. Application: Used in heavy industry (more specifically). Forestry, automotive, sheet metal rolling and pressing, system that detects velocity, position, shock, vibration, or the acceleration of gravity to determine orientation		
<b>UNIT 3</b>	<b>Power Transmission System</b>	<b>6 HOURS</b>
Mechanical transmission method - Gear transmission, Belt drives, cables, Roller chains, Link - Rod systems - Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws. Application: Electric screwdriver, dancing monster, oscillating sprinkler, windup alarm clock, washing machine and clothes dryer , automobiles , cooling towers.		
<b>UNIT 4</b>	<b>Manipulators</b>	<b>6 HOURS</b>
Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and Pneumatic manipulators. Application: Radioactive or bio hazardous materials, using robotic arms, or they were used in inaccessible places.		
<b>UNIT 5</b>	<b>Robot End Effectors</b>	<b>8 HOURS</b>
Classification of End effectors – Tools as end effectors. Drive system for grippers-Mechanical-adhesive-vacuum-magnetic-grippers. Hooks & scoops. Gripper force analysis and gripper design. Active and passive grippers. Application: Welding head, or a paint spray gun. end effector on the space shuttle’s robotic arm. uses a pattern of wires which close like the aperture of a camera around a handle or other grasping point.		
<b>UNIT 6</b>	<b>Virtual Instrumentation</b>	<b>6 HOURS</b>
Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data - flow techniques, graphical programming in data flow, comparison with conventional programming. Application: Require test, measurement, and control with rapid access to hardware and data insights, Measurements, test benches and Machine Vision than Industrial Automation.		


<b>PRACTICAL: Perform the following experiments.</b>		
<b>PRACTICAL NO.01</b>		<b>4 HOURS</b>
Study of different types of robots and Component requirement analysis of robot.		
<b>PRACTICAL NO.02</b>		<b>4 HOURS</b>
Demonstration of different types of sensors using discrete component and Electronics Trainer Kit.		
<b>PRACTICAL NO.03</b>		<b>4 HOURS</b>
Design and selection of transmission system required for particular mechanism.		
<b>PRACTICAL NO.04</b>		<b>4 HOURS</b>
Demonstration of Pneumatic or hydraulic actuators using mechatronics trainer kit.		
<b>PRACTICAL NO.05</b>		<b>4 HOURS</b>
Design and Simulate an actuator to pick and place objects of different shapes.		
<b>PRACTICAL NO.06</b>		<b>2 HOURS</b>
Design and simulate Data Acquisition System using LabView.		
<b>PRACTICAL NO.07</b>		<b>6 HOURS</b>
Capstone Project – Building a Bot		

### **TEXT BOOK**

1. Mikell P. Groover, Industrial Robots – Technology, Programming and applications, McGraw Hill, New York, 2014, ISBN :978-0070249899
2. Deb S. R. and Deb S., Robotics Technology and Flexible Automation, Tata McGraw Hill Education Pvt. Ltd, 2010. ISBN :978-0070077911
3. John J.Craig , Introduction to Robotics, Pearson, 2009 ,2nd edition , ISBN : 978-0201543612,

### **REFERENCE BOOK**

1. S.K.Saha, Introduction to robotics, Tata-McGraw-Hill Publication, ISBN: 978-0070140011
2. Richard Klafter, “Robotic Engineering: An Integrated Approach”, Prentice – Hall, ISBN: 978-8121926164.
3. Fu K S, Gonzalez R C, Lee C.S.G, Robotics: Control, Sensing, Vision and Intelligence, McGraw Hill, 1987, ISBN: 9780070226258

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Work Process Assessment
		<b>COURSE CODE</b>	ME313
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	Nil	50	150

**PRE-REQUISITE :** Engineering Graphics, Design Thinking

**COURSE OBJECTIVES :**

ME313.CEO.1: To study concepts of productivity.  
 ME313.CEO.2: To study the basics of finance.  
 ME313.CEO.3: To understand the concepts of work study, method study and time study.  
 ME313.CEO.4: To measure standard time to complete specific task with different techniques.  
 ME313.CEO.5: To study the parameters of ergonomics and propose the solution to increase human efficiency.

**COURSE OUTCOMES :**

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

ME313.CO.1: Define productivity concepts and principles.  
 ME313.CO.2: Recall the principles of ergonomics.  
 ME313.CO.3: Describe work study, method study and time study.  
 ME313.CO.4: Calculate standard time to carry out a specified job with different techniques.  
 ME313.CO.5: Design the man-machine system to improve human efficiency.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction to Work Study</b>	<b>6 HOURS</b>
Introduction to Industrial Engineering, Historical background, Contribution of Taylor and Gilbreth, Productivity – Definition, Types, Productivity of material, land, building, machine and power, Factors affecting the productivity, Numerical and Cases on Productivity Definition and scope of Work Study, Work study and management, Work study and supervision, Work study and worker.		
<b>UNIT 2</b>	<b>Method Study</b>	<b>8 HOURS</b>
Method Study: Definition, objective and scope of method study, Activity recording and exam aids, Charts to record moments in shop operation – process charts, flow process charts, travel chart and multiple activity charts. (With simple problems). Micro and memo motion study: Charts to record moment at workplace – principles of motion economy, Classification of moments two handed process chart, SIMO chart, Micro motion study. Development, definition and installation of the improved method, brief concept about synthetic motion studies.		
<b>UNIT 3</b>	<b>Work Measurement</b>	<b>6 HOURS</b>
Definition, objective and benefit of work measurement. Work measurement techniques. Work sampling: need, confidence levels, sample size determinations, random observation, conducting study with the simple problems.		
<b>UNIT 4</b>	<b>Time Study</b>	<b>8 HOURS</b>
Time Study, Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating & standard Rating, standard performance, scale of rating, factors of affecting rate of working, allowances and standard time determination. Predetermined motion time study – Method time measurement (MTM)		
<b>UNIT 5</b>	<b>Ergonomics</b>	<b>6 HOURS</b>
Introduction, areas of study under ergonomics, system approach to ergonomics model, man-machine system. Components of man-machine system and their functions – work capabilities of industrial worker, study of development of stress in human body and their consequences. Computer based ergonomics. DESIGN OF MAN-MACHINE SYSTEM: Fatigue in industrial workers, Quantitative qualitative representation and alphanumeric displays, Controls and their design criteria, control types, relation between controls and displays, layouts of panels and machines. Design of workplaces, influence of climate on human efficiency. Influence of noise, vibration and light.		
<b>UNIT 6</b>	<b>Introduction to Engineering Economy</b>	<b>6 HOURS</b>
Engineering Decision-Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy. Engineering Economic Decision, Maze. Law of demand and supply, Law of returns, Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loans and EMI Payment.		


<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>	<b>Productivity</b>	<b>2 HOURS</b>
Numerical on Productivity		
<b>PRACTICAL NO.02</b>	<b>Work Study</b>	<b>2 HOURS</b>
Review of a case study on productivity improvement using Work Study		
<b>PRACTICAL NO.03</b>	<b>Recording Tools &amp; Techniques</b>	<b>4 HOURS</b>
Assignment on Recording Tools & Techniques – Charts- Diagrams		
<b>PRACTICAL NO.04</b>	<b>Method Study</b>	<b>4 HOURS</b>
Case 1– Bagging Exercise – Method Study (Record, Examine) Case 2– Bagging Exercise – Method Study (Develop, Evaluate. Define)		
<b>PRACTICAL NO.05</b>	<b>Process Chart</b>	<b>4 HOURS</b>
Case – Toy Assembly – Earth Mover (Two handed process chart)		
<b>PRACTICAL NO.06</b>	<b>Workplace Design</b>	<b>4 HOURS</b>
Workplace Design using Principles of motion economy		
<b>PRACTICAL NO.07</b>	<b>Time Standards</b>	<b>4 HOURS</b>
Setting Time Standards using Video Time Study and MTM.		
<b>PRACTICAL NO.08</b>	<b>Work Sampling</b>	<b>2 HOURS</b>
Work Sampling Exercise		
<b>PRACTICAL NO.09</b>	<b>Ergonomics</b>	<b>2 HOURS</b>
Measurement of heart beat rate, calorie consumption parameters using walking simulator or cycle Ergometer		

<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. Introduction to work study, International Labour Office, Geneva, - III Revised Edition, 1981, ISBN 13: 9789221000112.</li> <li>2. Motion and Time study - Ralph M Barnes; John Wiley, 8th Edition, 1985, ISBN-13: 978-0471059059</li> <li>3. Engineered work Measurement - Weldon, ELBS, Marvin E. Mundel- Motion and Time study, PHI, 4th edition, ISBN-13: 978-0831111700</li> <li>4. Engineering Economy- Riggs J.L. McGraw Hill, 2002, ISBN 0-07912248-5.</li> </ol>

## REFERENCE BOOK

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1. Human Factors in Engineering Design 7- S Sanders and E J McCormick, 6th Edition, McGraw Hill, ISBN 0-07-054901-X.
2. Industrial Engineering Hand Book, Maynards H.B., third edition, New York and London, McGraw- Hill, ISBN-13: 978-0070411029
3. Work Study and Ergonomics, S Dalela and Sourabh, Chand Publishers, 3rd edition, ISBN-13: 978-8180141331
4. Industrial Engineering and Management–O. P.Khanna, Dhanpat Rai & Sons 2000, ISBN-818992835X

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>			<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>			<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>			<b>COURSE NAME</b>		Skill Development - Autodesk INVENTOR
			<b>COURSE CODE</b>		ME304
			<b>COURSE CREDITS</b>		2
<b>RELEASED DATE : 01/06/2018</b>			<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
-	4	-	-	-	-	50	50

**PRE-REQUISITE :** Engineering Graphics

**COURSE OBJECTIVES :**

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ME304.CEO.1: To Use AutoCAD for daily working process.  
 ME304.CEO.2: To Understand the fundamentals of computer aided design.  
 ME304.CEO.3: To learn different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication.  
 ME304.CEO.4: To enable the students to Create multiple designs using several of tools.

**COURSE OUTCOMES :**

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

ME304.CO.1: Identify the components of the AutoCAD user interface and basic CAD terminology.  
 ME304.CO.2: Utilize AUTOCAD features to create and modify drawings.  
 ME304.CO.3: Use professional-level CAD software to draw, read engineering.  
 ME304.CO.4: Apply the skills attained from 2D and 3D modelling to design working drawings using Inventor.

<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>	<b>AUTODESK INVENTOR INTRODUCTION</b>	<b>6 HOURS</b>
Autodesk Inventor Fundamentals Autodesk Inventor user Interface Model Manipulation, Designing Parametric Parts. Basic sketching techniques: Creating 2D sketches Geometric constraints Dimensioning sketches.		
<b>PRACTICAL NO.02</b>	<b>BASIC SHAPE DESIGN</b>	<b>8 HOURS</b>
Creating basic sketched features Intermediate sketching, editing parametric parts 3D grip editing, creating work features Creating basic swept shapes, Detailed shape design: Creating chamfers and fillets Creating holes and threads Patterning and mirroring features Creating thin-walled parts, Additional Features Face: Draft, Splitting a Face or Parts, Shells, Ribs, Bend Parts.		
<b>PRACTICAL NO.03</b>	<b>MODEL AND DISPLAY MANIPULATION</b>	<b>8 HOURS</b>
Reordering Features Inserting Features, Suppressing Features, Section Views, Design Views, Sweep Features, Loft Features, Duplication Tools		
<b>PRACTICAL NO.04</b>	<b>ASSEMBLY DESIGN</b>	<b>6 HOURS</b>
Assembly design overview, designing assemblies, Using project files in assembly designs, Joint Connections		
<b>PRACTICAL NO.05</b>	<b>PLACING, CREATING AND CONSTRAINING COMPONENTS</b>	<b>6 HOURS</b>
Placing components in an assembly Constraining components, placing standard components using the content center, Basic part design in an assembly		
<b>PRACTICAL NO.06</b>	<b>BASIC VIEW CREATION</b>	<b>6 HOURS</b>
Drawing creation environment Base and projected views Section views, Detail views Crop views Managing views.		
<b>PRACTICAL NO.07</b>	<b>DIMENSIONS, ANNOTATIONS AND TABLES</b>	<b>8 HOURS</b>
Automated dimensioning techniques Manual dimensioning techniques Annotating holes and threads, Creating centerlines, symbols and leaders, Revision tables and tags. Sheet Metal		
<b>PRACTICAL NO.08</b>	<b>ANNOTATING ASSEMBLY DRAWINGS</b>	<b>6 HOURS</b>
Assembly-centric bill of materials Creating and customizing parts Lists Creating balloons, Drawing standards and resources.		



**TEXT BOOK**


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1. AutoCAD 2017(R1):3D Drawing & Modeling Autodesk Authorized Publisher ISBN- 978-1943184262

**REFERENCE BOOK**

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1. Autodesk Inventor 8 Essentials Plus 3rd Ed Edition Alan Kalameja, Daniel T. Banach, Travis Jones ISBN: 9781401864965

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Skill Development - CATIA
		<b>COURSE CODE</b>	ME305
		<b>COURSE CREDITS</b>	2
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
-	4	-	-	-	-	50	50

**PRE-REQUISITE :** Engineering Graphics

**COURSE OBJECTIVES :**

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ME305.CEO.1: To get acquainted with PLM structure  
 ME305.CEO.2: To design product in digital environment and design procedure implementation using CAD/CAM applications for better, efficient and fast product development


**COURSE OUTCOMES :**

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The students after completion of the course will be able to,  
 ME305.CO.1: Make Database in PLM Environment.  
 ME305.CO.2: Apply various tools for modeling, assembly & surfacing.  
 ME305.CO.3: Design new products in 3D digital environment.

<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>	<b>Introduction to CATIA V6 PLM</b>	<b>6 HOURS</b>
Import the existing CATIA V5 data and store in V6, Search and identify the data located in V6 database, Modify the data in any PLM process, Sharing information with users, Save the modifications into database		
<b>PRACTICAL NO.02</b>	<b>Part Design</b>	<b>10 HOURS</b>
Introduction to Sketcher Analyzing the degrees of freedom of the sketch Sketch based features Dress up features		
<b>PRACTICAL NO.03</b>	<b>Assembly Design</b>	<b>10 HOURS</b>
Introduction to assembly design Importing existing parts into assembly design Positioning the parts at their respective positions Defining the assembly constraints Saving assembly into the database		
<b>PRACTICAL NO.04</b>	<b>Drafting</b>	<b>10 HOURS</b>
Introduction to generative drafting Frame, title block and view generation Saving a drawing document and its links Additional view generation using detail and clipping Adding section views and cuts for detail information		
<b>PRACTICAL NO.05</b>	<b>Generative Shape Design - Surfacing</b>	<b>20 HOURS</b>
Wireframe creation to create skeleton for surfaces Creation of basic surfaces Surface Operation Assemble, relimit and connect the surfaces		

<b>REFERENCE BOOK</b>
1. Documentation of Dassault Systemes for CATIA

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>		<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>		Turbomachines
		<b>COURSE CODE</b>		ME321
		<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
3	2	30	40	30	50	-	150

**PRE-REQUISITE :** Thermal Engineering, Fluid Mechanics

**COURSE OBJECTIVES :**

ME321.CEO.1: To recall the basics of Fluid Mechanics and Thermodynamics.

ME321.CEO.2: To explain the velocity triangle of different turbo machines

ME321.CEO.3: To provide the students with opportunities to apply basic thermo-fluid dynamics flow equations to Turbo machines.

ME321.CEO.4: To distinguish the different turbo machines based on characteristic curves, specific speed and heads.

ME321.CEO.5: To measure the performance of turbines, pumps and compressors by using velocity triangles.

**COURSE OUTCOMES :**

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

ME321.CO.1: Define the power producing and power consuming devices.

ME321.CO.2: Classify the different turbomachines.

ME321.CO.3: Solve the turbomachines problem by using basic knowledge of fluid machines and thermodynamics

ME321.CO.4: Analyze the effect of various parameters on the overall performance of turbomachines.


ME321.CO.5: Evaluate the performance of turbines, pumps and compressors by using velocity triangles.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Impulse momentum principle and its application</b>	<b>6 HOURS</b>
Classification, Euler's turbomachinery equation, Applications , Impulse momentum principle and its applications, Force exerted on fixed and moving flat plate, hinged plate, curved vanes, series of flat plates and radial vanes, velocity triangles and their analysis, work done equations, vane efficiency.		
<b>UNIT 2</b>	<b>Hydraulic Turbines</b>	<b>8 HOURS</b>
Classification of hydraulic Turbines, Pelton, Francis, Kaplan and propeller turbines, velocity triangles, Alternate form of Euler's turbine equation, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, power and efficiency calculations, specific speed and its significance, draft tube, cavitation, governing of impulse and reaction turbines, performance characteristics (operating and main characteristics), Design parameters for all the three turbines		
<b>UNIT 3</b>	<b>Steam Turbines</b>	<b>8 HOURS</b>
Stream nozzles: Types and applications Steam turbines; basic cycle, impulse and reaction turbines, compounding of steam turbines, Parsons' turbine and its condition for maximum utilization factor, reaction staging, velocity triangles and analysis		
<b>UNIT 4</b>	<b>Pumps</b>	<b>8 HOURS</b>
Centrifugal Pumps: Introduction, classification of pumps, Pumping System and the Net Head Developed, Centrifugal pump components and their functions. Euler Head, various efficiencies, Need of priming, pump characteristics, Pumping systems and system head curves, Operating point model testing, Pumps in Series and Parallel, NPSH & Cavitation in Pumps: Calculation of NPSH (A) and its significance, Effect of blade discharge angle on performance.		
<b>UNIT 5</b>	<b>Centrifugal compressor and Axial compressor</b>	<b>6 HOURS</b>
Centrifugal Compressors: Components, Work done & pressure rise, enthalpy entropy diagram, Slip factor, Power input factor, various losses in centrifugal compressor, Performance characteristics, surging choking phenomenon Axial flow Compressors: Work done and Pressure rise, Degree of reaction, losses and efficiency, Stalling, Compressor characteristics		
<b>UNIT 6</b>	<b>Jet Propulsion</b>	<b>6 HOURS</b>
Propulsion Cycles: Jet Propulsion Cycles and their Analysis for turbojet, turboprop and turbofan engines-efficiency and specific thrust Factors Affecting Flight Performance & Methods of Thrust Augmentation		

<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>	<b>Impulse momentum principle</b>	<b>4 HOURS</b>
Verification of impulse momentum principle		
<b>PRACTICAL NO.02</b>	<b>Pelton wheel</b>	<b>4 HOURS</b>
Trial on impulse water turbine (Pelton wheel) and plotting of main and operating characteristics		
<b>PRACTICAL NO.03</b>	<b>Francis Turbine</b>	<b>4 HOURS</b>
Trial on hydraulic reaction turbine (Francis Turbine) and plotting of main and operating characteristics		
<b>PRACTICAL NO.04</b>	<b>Centrifugal pump</b>	<b>4 HOURS</b>
Trial on centrifugal pump and plotting operating characteristics		
<b>PRACTICAL NO.05</b>	<b>Centrifugal air compressor</b>	<b>4 HOURS</b>
Trial on centrifugal air compressor and plotting its characteristics		
<b>PRACTICAL NO.06</b>	<b>Visit to hydro/steam power plant</b>	<b>4 HOURS</b>
Visit to hydro/steam power plant and report to be submitted.		
<b>PRACTICAL NO.07</b>	<b>Case Study</b>	<b>4 HOURS</b>
Case study on any one hydro/steam power plant.		

<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. Turbines, Compressors &amp; Fans, S.M. Yahya, Tata-McGraw Hill. ISBN: 9781259000720 Turbo-machines, B. U. Pai, Wiley India. ISBN: 9788126539550</li> <li>2. Fluid mechanics and hydraulic machines, Dr. R.K. Bansal. ISBN-13: 978-8131808153</li> <li>3. Hydraulic Machines, Dr. J. Lal, Metropolitan Book Co. Pvt. Ltd., Delhi. ISBN-13: 978-8120000261</li> <li>4. Hydraulics, Fluid Mechanics and Machinery, Modi P N &amp; Seth S N, Standard Book House, New Delhi. ISBN: 9788189401269</li> <li>5. R. Yadav, Steam and Gas Turbines and Power Plant Engineering, VII edition, Central Publ. house. ISBN-13: 978-8185444352</li> </ol>

<b>REFERENCE BOOK</b>
<ol style="list-style-type: none"> <li>1. William W. Perg, Fundamentals of Turbomachinery, John Wiley &amp; Sons.</li> <li>2. Thermal Turbomachines, Dr. Onkar Singh, Wiley India. ISBN: 9788126546855</li> <li>3. V. P. Vasandani, Theory of Hydraulic Machinery, Khanna Publishers, Delhi. ISBN-13: 978-8174092502</li> <li>4. Karassik, Hand Book of Pumps, Tata McGraw Hills Ltd., New Delhi. ISBN: 9780071460446</li> <li>5. S.L. Dixon, Fluid Mechanics, Thermodynamics of Turbomachinery, IV edition, Butterworth-Heinemann Publ., 1966. ISBN-13: 978-0124159549</li> </ol>

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Quality Assurance
		<b>COURSE CODE</b>	ME322
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	25	25	150

**PRE-REQUISITE :** Engineering Tools & Techniques

**COURSE OBJECTIVES :**

ME322.CEO.1: To understand metrology, its advancement & measuring instruments.  
 ME322.CEO.2: To study fundamentals of inspection methods and systems.  
 ME322.CEO.3: To understand advancement in metrology like CMM.  
 ME322.CEO.4: To suggest appropriate Quality Management System for given application.  
 ME322.CEO.5: To select and apply Quality control methods for given applications.

**COURSE OUTCOMES :**

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

ME322.CO.1: Identify different measurement standards as per application.  
 ME322.CO.2: Explain the tolerance, limits of size, fits and gauge design.  
 ME322.CO.3: Describe measurements of threads, gears.  
 ME322.CO.4: Apply QC tools at appropriate application.  
 ME322.CO.5: Prepare the Quality Control Plan, Recommend corrective action.


<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction to Metrology</b>	<b>6 HOURS</b>
Metrology, Errors, Calibration, Types of Geometric Form Measurement, Accuracy and Precision.		
<b>UNIT 2</b>	<b>Metrological Applications</b>	<b>8 HOURS</b>
Design of gauges, System of Limits, Fits and Tolerances, Comparators, Thread and Gear Metrology, Surface Roughness, Measurement, Force and torque measurement, Strain measurement, Temperature measurement, Laser technology in measurements, Interferometer, Machine Vision System, Coordinate Measuring Machine.		
<b>UNIT 3</b>	<b>Quality Control in various Industrial sectors</b>	<b>6 HOURS</b>
Quality control methods and parameters in different industries like Automobile, Food, Pharma, CAD, Electronic and Electrical components manufacturing.		
<b>UNIT 4</b>	<b>Introduction to Quality Tools</b>	<b>6 HOURS</b>
Concept of quality, Deming's cycle, Juran's Trilogy approach, Seven Tools, Quality in Manufacturing, Quality Control Plan.		
<b>UNIT 5</b>	<b>Statistical Quality Control Tools</b>	<b>8 HOURS</b>
Frequency diagrams, Variance Analysis, Control Chart, Pie charts, histograms, Statistical process control, Process capability. Sampling Techniques, QC curve, Use of sampling tables		
<b>UNIT 6</b>	<b>Total Quality Management</b>	<b>6 HOURS</b>
Concepts of 5S, Kaizen, Poka Yoke, Kanban, JIT, Six sigma, Zero Defects. Quality Management Systems, ISO 9001, ISO 14000, OHSAS18001		



<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>	<b>Error Measurements</b>	<b>2 HOURS</b>
Error measurement in linear/angular measurement.		
<b>PRACTICAL NO.02</b>	<b>Dimension and Geometrical Measurements</b>	<b>4 HOURS</b>
Use of pneumatic comparator for dimensions and geometrical measurements.		
<b>PRACTICAL NO.03</b>	<b>Measurement of Gear Parameters</b>	<b>4 HOURS</b>
Gear parameter measurement using Gear Tooth Vernier.		
<b>PRACTICAL NO.04</b>	<b>Measurement of Surface Roughness</b>	<b>4 HOURS</b>
Surface roughness measurement using surface roughness tester		
<b>PRACTICAL NO.05</b>	<b>Application of Profile Projector</b>	<b>4 HOURS</b>
Use of profile projector and tool maker's microscope for determination of complex geometrical applications.		
<b>PRACTICAL NO.06</b>	<b>Machine alignment Testing</b>	<b>4 HOURS</b>
Machine Tool Alignment Testing.		
<b>PRACTICAL NO.07</b>	<b>Case Study</b>	<b>4 HOURS</b>
TQM Case study.		
<b>PRACTICAL NO.07</b>	<b>Industrial Visit</b>	<b>4 HOURS</b>
Visit to CMM facility.		

<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. Mechanical Measurements, Beckwith Marangoni and Lienhard, Pearson Education, 6th Edition, 2006. ISBN-13: 978-0201847659.</li> <li>2. Engineering Metrology, R. K. Jain, Khanna Publishers, Delhi, 2009. ISBN: 978-81-7409-153-X.</li> <li>3. Juran J.M., Quality Handbook, McGraw Hill Publications. ISBN: 9780071070898.</li> <li>4. Grant S.P., Statistical Quality Control, Tata McGraw Hill Publication. ISBN 13: 9780070435551.</li> </ol>

<b>REFERENCE BOOK</b>
<ol style="list-style-type: none"> <li>1. Narayana K.L., Engineering Metrology. ISBN: 8183711189, 9788183711180.</li> <li>2. ASTM E, Handbook of Industrial Metrology, Prentice Hall of India Ltd.</li> <li>3. Connie Dotson, Fundamentals of Dimensional Metrology, Thomson Publ, 4th Edition. ISBN-13: 978-0766820715</li> <li>4. Kulkarni V.A. and Bewoor A.K., Quality Control, John Wiley Publication. ISBN: 9788126519071</li> </ol>

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>		<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>		Oprations Research
		<b>COURSE CODE</b>		ME323
		<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>		0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	25	25	150

**PRE-REQUISITE :** Applied Mathematics

**COURSE OBJECTIVES :**

ME323.CEO.1: To understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand.

ME323.CEO.2: To understand the relationship between a linear program and its dual, including strong duality and complementary slackness.

ME323.CEO.3: To Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.

ME323.CEO.4: To solve specialized linear programming problems and network models.

**COURSE OUTCOMES :**

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

ME322.CO.1: Identify and develop operational research models from the verbal description of the real system.

ME322.CO.2: Apply the mathematical tools that are needed to solve optimization problems.

ME322.CO.3: Use mathematical software to solve the proposed models.

ME322.CO.4: Solve specialized linear programming problems like the transportation and assignment problems.

ME322.CO.5: Solve network models like the shortest path, minimum spanning tree, and maximum flow problems.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Fundamentals of Operation Research</b>	<b>6 HOURS</b>
Introduction, Graphical Method, Simplex Method, Big M Method, Two Phase Simplex Method, Degeneracy. Decision Theory: Steps in Decision Making, Types of Management Decisions, Decision under Certainty, under Risk, under Uncertainty, Decision Trees.		
<b>UNIT 2</b>	<b>Transportation and Assignment Problem</b>	<b>6 HOURS</b>
Specific features of transportation problem, NW Corner Rule, Matrix Minima Method, VAM, MODI Method Stepping Stone Method, Mathematical Formulation of an Assignment Problem, Hungarian Method, Unbalanced Assignment Problem, Travelling Salesman Problem.		
<b>UNIT 3</b>	<b>Theory of Games and Dynamic Programming</b>	<b>8 HOURS</b>
Types of Games: Maximin–Minimax Principle, 2*2 Games without Saddle Points, 2*N or M*2 Games, Dominance Property, Use of L.P. to games. Dynamic Programming: Characteristics, principle of optimality, solution procedure, deterministic problems		
<b>UNIT 4</b>	<b>Network Scheduling</b>	<b>8 HOURS</b>
Introduction, Fulkerson’s Rule, Time Analysis, CPM, PERT Procedure, Cost Consideration in CPM and PERT		
<b>UNIT 5</b>	<b>Waiting Line Theory and Sequencing Model</b>	<b>8 HOURS</b>
Queuing System, Kendall’s Notation, Birth and Death Model, N/FCFS Model, Multiservice Model, M/FCFS Model. Solution of sequencing Problem - Processing of n jobs through two machines, Processing of n jobs through three machines, Processing of two jobs through m Machines, Processing of n jobs through m Machines		
<b>UNIT 6</b>	<b>Investment Analysis and Inventory Control</b>	<b>6 HOURS</b>
Break-Even Analysis, Payback Period Method, DCF Method, IRR Method, Introduction to Probabilistic Models. Deterministic Models, Probabilistic Inventory Models, Replacement of Items that deteriorate and Fail suddenly.		

<b>PRACTICAL: Perform following experiments using MATLAB or Open source software.</b>		
<b>PRACTICAL NO.01</b>	<b>Big M Methods.</b>	<b>4 HOURS</b>
Program on Big M Method		
<b>PRACTICAL NO.02</b>	<b>Transportations</b>	<b>4 HOURS</b>
Program on Transportation Problem		
<b>PRACTICAL NO.03</b>	<b>Assignment Problem.</b>	<b>4 HOURS</b>
Program on Assignment problem		
<b>PRACTICAL NO.04</b>	<b>Optimization by using suitable solver.</b>	<b>4 HOURS</b>
Demonstration of optimization problem using suitable solver		
<b>PRACTICAL NO.05</b>	<b>Game theory</b>	<b>4 HOURS</b>
Program on Theory of Games		
<b>PRACTICAL NO.06</b>	<b>Case study</b>	<b>4 HOURS</b>
Case Study on Network Scheduling		
<b>PRACTICAL NO.07</b>	<b>Break even analysis</b>	<b>2 HOURS</b>
Program on Break Even Analysis or IRR Method		
<b>PRACTICAL NO.08</b>	<b>Birth and death model.</b>	<b>2 HOURS</b>
Demonstration of Birth and Death model or Multi service model		


### **TEXT BOOK**

1. Hillier F.S., and Lieberman G.J., Operations Research, Eight Edition, Mc. Tata McGraw Hill, India. ISBN-13: 978-0070600928
2. N. D. Vora, Quantitative Techniques. ISBN-13: 978-0070146730
3. Gupta P. K. and Hira D. S.: Operations Research, S Chand & Company Ltd. ISBN13: 9788121902816
4. Sharma S. D., Kedar Nath : Operations Research, Ram Nath & Co., ISBN:-13 5551234001596

## REFERENCE BOOK

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1. Taha H. A.: Operations Research: An Introduction, Prentice Hall of India Pvt. Ltd. ISBN-13: 978-0132555937.
2. Belegundu, — Optimization Concepts and Applications in engineering, Cambridge Uni. Press, India ISBN-13: 978-0521878463.
3. Hamdy A Taha, Operations Research - An introduction, Pearson Education. ISBN: 9780132555937.
4. Ravindran, Phillips and Solberg, Operations Research Principles and Practice, Second Edition, Mc.WSE Willey, ISBN: 978-0-471-08608-6.
5. Wagner H. N.: Principles of Operations Research with applications to Managerial Decisions, Prentice Hall of India Pvt. Ltd. ISBN-13: 978-0137095926.

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Finite Element Analysis
		<b>COURSE CODE</b>	ME331
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	50	-	150

**PRE-REQUISITE :** Geometric Modeling & Design

**COURSE OBJECTIVES :**

ME331.CEO.1: To equip the students with the Finite Element Analysis fundamentals.

ME331.CEO.2: To enable the students to formulate the design problems into FEA.

ME331.CEO.3: To enable the students to perform engineering simulations using Finite Element Analysis software (ANSYS/Optistruct).

ME331.CEO.4: To enable the students to understand the ethical issues related to the utilization of FEA in the industry.

**COURSE OUTCOMES :**

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

ME331.CO.1: Identify mathematical model for solution of common engineering problems.

ME331.CO.2: Formulate simple problems into finite elements..

ME331.CO.3: Solve for modeling and meshing of structural problems.

ME331.CO.4: Use professional-level finite element software to solve engineering problems in Solid mechanics.

ME331.CO.5: Derive element matrix equation by different methods by applying basic laws in mechanics and integration by parts.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Fundamentals of FEA</b>	<b>8 HOURS</b>
Basics of Solid Mechanics, Basic equations of elasticity, Equilibrium equation in elasticity, plane stress, plane strains, Solution methodologies to solve engineering problem, Failure Analysis of product, Review of Theories of Failures, Past, Present & Future of FEA, FEA Terminology, General Procedure of FEA, Introduction to Types of Analysis.		
<b>UNIT 2</b>	<b>Discretization and Basic Procedure</b>	<b>6 HOURS</b>
Introduction to meshing/ discretization, Introduction to different element types, 1D, 2D & 3D Meshing, Mesh Quality Check, Boundary Conditions. Introduction to different approaches used in FEA such as direct approach, Variational approach, weighted residual, energy approach, Galerkin and Raleigh Ritz approach.		
<b>UNIT 3</b>	<b>1 D Elements: Springs &amp; Bars</b>	<b>8 HOURS</b>
Types of 1D elements, displacement function, global and local coordinate systems, polynomial form of interpolation functions- linear, quadratic and cubic, properties of shape function, primary and secondary variables. Formulation of elemental stiffness matrix and load vector for Spring, bar using any approach, Assembly of global stiffness matrix and load vector, properties of stiffness matrix, half bandwidth, treatment of boundary conditions- elimination approach, stress and reaction forces calculations.		
<b>UNIT 4</b>	<b>1 D Elements: Beams &amp; Truss</b>	<b>6 HOURS</b>
Shape functions, Formulation of elemental stiffness matrix and load vector for truss and beam using any approach, Assembly of global stiffness matrix and load vector, treatment of boundary conditions-elimination approach, stress and reaction forces calculations.		
<b>UNIT 5</b>	<b>2D Elements</b>	<b>8 HOURS</b>
Two-Dimensional Stress Analysis: Plane Stress/Strain problems in 2D elasticity, constitutive relations Constant Strain Triangle(CST), Liner Strain Rectangle (LSR), displacement function, Pascal's triangle, compatibility and completeness requirement, geometric isotropy, convergence requirements, strain filed, stress filed, Formulation of element stiffness matrix and load vector for Plane Stress/Strain problems .Assembly of global stiffness matrix and load vector, Boundary conditions, solving for primary variables (displacement), stress calculations		
<b>UNIT 6</b>	<b>1D Steady State Heat Transfer</b>	<b>6 HOURS</b>
Review of modes of HT Conduction, convection, radiation, Governing Differential Equation, Boundary conditions, Steady State Heat transfer formulation of 1D elements for conduction and convection.		

<b>PRACTICAL: Perform following practical's.</b>		
<b>PRACTICAL NO.01</b>	<b>Modeling &amp; Meshing Using 2D Elements</b>	<b>6 HOURS</b>
Modeling and meshing of plate with 2 D tria and quad Element using Hypermesh with quality check		
<b>PRACTICAL NO.02</b>	<b>Modeling &amp; Meshing Using 3D Elements</b>	<b>6 HOURS</b>
Modeling and meshing of any 3 D machine component using Hypermesh with quality check		
<b>PRACTICAL NO.03</b>	<b>Analysis of Plate with Hole</b>	<b>4 HOURS</b>
Static stress concentration factor calculation for a plate with center hole subjected to axial loading in tension using FEA software.(ANSYS/ Optistruct)		
<b>PRACTICAL NO.04</b>	<b>Analysis of Machine Component for Stress, Strain</b>	<b>4 HOURS</b>
Stress and deflection analysis of any machine component consisting of 3-D elements using FEA Software (ANSYS/ Optistruct).		
<b>PRACTICAL NO.05</b>	<b>Analysis of Beam</b>	<b>4 HOURS</b>
Find Deflection, Stress and Strains in Beam with various cross sections with various loads and validate with numerical results.		
<b>PRACTICAL NO.06</b>	<b>Analysis of Bar</b>	<b>4 HOURS</b>
Find Deflection, Stress and Strains in Bar with various cross sections with various loads and validate with numerical results.(Also take composite bars)		


### TEXT BOOK

1. J. N. Reddy, An Introduction to the Finite Element Method, Tata McGraw-Hill.ISMN-13-9780070513556
2. C.S. Krishnamurthy, Finite Element Analysis: Theory & Programming, TMH Publishing Co.
3. Reddy J. N., An Introduction to Finite Element Methods, McGraw Hill Company, 1984. ISBN-13-978-0072466850

### REFERENCE BOOK

1. Trupathi R Chandrupatla and Ashook D. Belegundu, Introduction of Finite Element in Engineering, Prentice Hall of India, 1997.ISBN-13- 978-0132162746
2. K.J. Bathe, Finite Element Procedures, Klaus-Jurgen Bathe.ISMB-13- 978-0133173055
3. O.C. Zienkiewicz , The Finite Element Method.ISBN-13- 978-1856176330
4. Rao S. S., The Finite Element Methods of Engineering, Pergamon Press, 1989.ISBN-13- 978-1856176613
5. Segerland L. J., Applied Finite Element Analysis, Wiley Publication, 1984-ISMn-13- 978-0471806622
6. Gokhale N. S., Deshpande S. S., Bedekar S. V. and Thite A. N., —Practical Finite Element Analysis, Finite to Infinite, Pune



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<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Kinematics & Dynamics of Robots
		<b>COURSE CODE</b>	ME332
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	-	50	150

**PRE-REQUISITE :** Fundamentals of Robots, Machines & Mechanisms

**COURSE OBJECTIVES :**

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ME332.CEO.1: To List configurations of robot.  
 ME332.CEO.2: To Apply design considerations in Trajectory Planning.  
 ME332.CEO.3: To Analyze concept of kinematics and dynamics for position control.  
 ME332.CEO.4: To Create a Task based robot system.

**COURSE OUTCOMES :**

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


ME332.CO.1: Enlist the configurations of robot.  
 ME332.CO.2: Prepare trajectory design plan for shooting robot.  
 ME332.CO.3: Combine kinematics and dynamics for position control.  
 ME332.CO.4: Create a Programmable Robot with Transformed Mechanisms..

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction to Robotics</b>	<b>8 HOURS</b>
Introduction to Robotics, Introduction & Basic concepts of robotics, Different configuration robots, Robot performance, Homogenous transformation, Euler's Angle.		
<b>UNIT 2</b>	<b>Robot Kinematics and Dynamics</b>	<b>8 HOURS</b>
Direct kinematics of a manipulator, Inverse kinematics, Geometric approach for inverse kinematics, Algebraic approach for inverse kinematics.		
<b>UNIT 3</b>	<b>Trajectory Planning and Manipulator Control</b>	<b>6 HOURS</b>
Introduction to trajectory planning, Cartesian space & Joint Space Technique, Manipulator control –Linear, 2nd order, force control, modeling and control of a single joint.		
<b>UNIT 4</b>	<b>End effectors, sensors and vision systems</b>	<b>6 HOURS</b>
End effectors –Types & working, Sensor-need, classification of Sensor, desirable features, Introduction to RCC, Need of vision system		
<b>UNIT 5</b>	<b>Balancing</b>	<b>8 HOURS</b>
Centre of Gravity, Static balancing - Dynamic balancing - Balancing of revolving masses - Balancing of reciprocating masses - Balancing machines.		
<b>UNIT 6</b>	<b>Robotic System design and applications</b>	<b>4 HOURS</b>
Robot design, Manipulator Mechanism Design, Actuation Scheme, Robot application -Material handling, loading/unloading, palletizing, inspection and Processing, Robotic actuators, types, working principle		

<b>PRACTICAL: Perform the following experiments.</b>		
<b>PRACTICAL NO.01</b>		<b>4 HOURS</b>
Study and demonstration of different mechanisms.		
<b>PRACTICAL NO.02</b>		<b>4 HOURS</b>
Detailed study report - Design of Robotic Transmission System.		
<b>PRACTICAL NO.03</b>		<b>4 HOURS</b>
Design and Simulate an actuator to pick and place objects of different shapes using CATIA or similar Software.		
<b>PRACTICAL NO.04</b>		<b>4 HOURS</b>
Study of robotic arm and its configuration – Each group has to present one design.		
<b>PRACTICAL NO.05</b>		<b>4 HOURS</b>
Study and demonstration of trajectory system for Robots.		
<b>PRACTICAL NO.06</b>		<b>2 HOURS</b>
Static and dynamic balancing of robot.		
<b>PRACTICAL NO.07</b>		<b>2 HOURS</b>
Critical speed analysis of different robots.		
<b>PRACTICAL NO.07</b>		<b>4 HOURS</b>
Capstone Project – Building of Task Based Robot.		

<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. Reza Jazar, Theory of Applied Robotics,2010, Springer US, ISBN – 978-0-387-68964-</li> <li>2. Ambekar A.G., “Mechanism and Machine Theory” Prentice Hall of India, New Delhi, 2007 ISBN :978-8120331341</li> <li>3. Shigley J.E., Pennock G.R and Uicker J.J., “Theory of Machines and Mechanisms”, Oxford University Press, 2003, 978-0190264482.</li> </ol>

<b>REFERENCE BOOK</b>
<ol style="list-style-type: none"> <li>1. Rao.J.S. and Dukkipatti R.V. “Mechanisms and Machines”, Wiley-Eastern Ltd., New Delhi, 1992.ISBN 13 : 978-8177581270.</li> <li>2. Richard D. Klafter, Thomas. A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated Approach, Phi Learning., 2009. ISBN-1-59047-816-9.</li> <li>3. John Hannah and Stephens R.C., “Mechanics of Machines”, Viva Low Prices Student Edition, 1999, 978-0713132311.</li> </ol>

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Facility Planning & Management
		<b>COURSE CODE</b>	ME333
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	25	25	150

**PRE-REQUISITE :** Work Process Assessment

**COURSE OBJECTIVES :**

ME333.CEO.1: To study the basics of maintenance and safety measures in industry.  
 ME333.CEO.2: To study and discuss different parameters affecting business location.  
 ME333.CEO.3: To study and suggest material handling system for specific application.  
 ME333.CEO.4: To study different elements of costing for engineering products and services.  
 ME333.CEO.5: To study the existing plant layout and propose new improved layouts.

**COURSE OUTCOMES :**

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

ME333.CO.1: Recall basics of Maintenance and safety measures in industry.  
 ME333.CO.2: Identify location of facilities for business organizations.  
 ME333.CO.3: Apply fundamental principles of material handling.  
 ME333.CO.4: Calculate the cost of given engineered product and service.  
 ME333.CO.5: Design new layouts incorporating products, process and personnel requirements for manufacturing and service organizations.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction to facility planning</b>	<b>8 HOURS</b>
Plant Location: Factors influencing plant location, Theories of plant location and Locational Economics. Capitals- Objectives of plant layout, Principles of plant layout, Types of plant layout, their merits and demerits.		
<b>UNIT 2</b>	<b>Material Handling</b>	<b>8 HOURS</b>
Principles of Material Handling, Material Handling Function, Scope and Functions of Material Handling, Manual Mechanical Handling Ratio, MH Equipment Types, Positioning Equipment, Unit Load Equipment, Auto Identification & Control Equipment, Transport Equipment – Conveyors, Cranes, Industrial Trucks. Storage Equipment, AGVs & Robots		
<b>UNIT 3</b>	<b>Plant layout design</b>	<b>6 HOURS</b>
Plant Layout Design: Traditional Layout procedures: Immer’s Basic Steps, Nadler’s ideal systems approach, Muther’s SLP, Apple’s Plant Layout Procedure and Reed’s procedure, Activity relationship chart, relationship Diagram, Space relationship diagram. Computerized Layout Planning: Classification of Layout Algorithms – distance based Vs. Adjacency based approaches, Pairwise Exchange Method, Graph based method. CRAFT, CORELAP, ALDEP – Input requirements and procedure Introduction to Simulated Annealing and Genetic Algorithm in Layout design.		
<b>UNIT 4</b>	<b>Space utilization and construction of layout</b>	<b>6 HOURS</b>
Space Determination & Area Allocation: Factors for consideration in space planning, receiving, storage, production, shipping, tool room and tool crib, other auxiliary service actions. Establishing total space requirement. The area allocation procedure, the plot plan. Constructing the Layout: Methods of constructing the layout, Evaluation of layout, Efficiency indices, Presenting layout to management.		
<b>UNIT 5</b>	<b>Maintenance and safety</b>	<b>6 HOURS</b>
Role of Maintenance Management, Organization & Systems of Maintenance Management, Types of Maintenance: Breakdown, Preventive, Predictive. Industrial Safety – Training for Safety, Communicating Safety Messages, Safe Practices in Industry, Safety Considerations in Manual & Mechanical Handling, Transportation, Role of Factory Inspector, Safety Officer		
<b>UNIT 6</b>	<b>Engineering Economy - Estimating and Costing</b>	<b>6 HOURS</b>
Components of costs such as Direct Material Costs, Direct Labor Costs, Fixed Overheads, Factory cost, Administrative Overheads, first cost, Marginal cost, Selling price, Estimation for simple components.		


<b>PRACTICAL: Perform following practical's.</b>		
<b>PRACTICAL NO.01</b>	<b>Case study of facility layout</b>	<b>18 HOURS</b>
<p>Student should visit industry at least for the duration of 50 hours. Should submit the report which should include</p> <ol style="list-style-type: none"> <li>1. Single facility location problems or Multiple facility location problems</li> <li>2. Line Balancing</li> <li>3. Computerized Layout Planning</li> <li>4. Layout Evaluation Techniques</li> </ol> <p>Based on study, student should give suggestions on layout improvement or improvement on material handling system, which should be acknowledged by respective industry.</p>		
<b>PRACTICAL NO.02</b>	<b>Making of Techno-commercial quotation for given product</b>	<b>10 HOURS</b>
<p>To make a detailed costing with BOM and techno-commercial quotation for given products like Mechanical structure, Special purpose machines, Special measurement gauge etc.</p>		

#### **TEXT BOOK**

1. Facilities Planning – James A.Tomkins, John A.White, Yavuz A. Bozer, J M. A. Tanchoco, John Wiley and Sons, 2010, ISBN 978-0-470-44404-7.
2. Plant Layout and Material handling - James M Apple, John, Wiely and Sons, 2nd Edition,1977 ISBN-13: 978-0471071716.
3. Facility layout and Location - Francies,R.L. and White,J.A., McGraw Hill 2nd edition, ISBN-13: 978-0132992312.
4. Engineering Economy - Paul Degarmo, Macmillan Pub, Co. 2001, ISBN-00-23286008.

#### **REFERENCE BOOK**

1. Practical layout - Muther Richard, McGraw Hill-1955. ISBN-13: 978-0070441569.
2. Facilities Design – Sunderesh Heragu, PWS Publishing Company, ISBN-0-534-95183.
3. Plant Layout Design - James M Moore, McMilan Co.1962 LCCCN61- 5204.

 <b>Academy of Engineering</b> (An Autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>	Basic Entrepreneurship
		<b>COURSE CODE</b>	HP 303
		<b>COURSE CREDITS</b>	1
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	CA			
-	2	NIL	NIL	25	NIL	25	50

**PRE-REQUISITE:** WF Orientation Course

**COURSE OBJECTIVES :**

HP303.CEO.1: To understand the fit between you and your entrepreneurial ambitions

HP303.CEO.2: To find a problem worth solving

HP303.CEO.3: To identify your customers

HP303.CEO.4: To develop a solution for your customers' problems and problem solution

HP303.CEO.5: To build and demonstrate an MVP

HP303.CEO.6: To structure a business model around the problem, customer, and solution and present your Business Model Canvas.

**COURSE OUTCOMES :**

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

HP303.CO.1: Why entrepreneurship requires

HP303.CO.2: Outline the Problems Worth Solving by using various techniques like DT, JTBD

HP303.CO.3: Identify the Customer Segments and Early Adopters

HP303.CO.4: Develop the solution demo for identify problem.

HP303.CO.5: Create Business Model Canvas and Minimum Viable Product


<b>PRACTICALS:</b>		
<b>PRACTICAL NO.01</b>	<b>GET STARTED - Discover Yourself</b>	<b>2 HOURS</b>
Find your flow, Effectuation, Case Study: Tristan Walker: The extroverted introvert, Identify your entrepreneurial style.		
<b>PRACTICAL NO.02</b>	<b>IDEA/PROBLEM - Identify Problems Worth Solving</b>	<b>4 HOURS</b>
What is a business opportunity and how to identify it. Find problems around you that are worth solving. Methods for finding and understanding problems - (Observation, Questioning, DT, Jobs to be done (JTBD) How to run problem interviews to understand the customer's worldview Introduction to Design Thinking - Process and Examples Generate ideas that are potential solutions to the problem identified - DISRUPT GOOTB: Run problem interviews with prospects Class Presentation: Present the problem you "love" Form teams		
<b>PRACTICAL NO.03</b>	<b>CUSTOMER</b>	<b>6 HOURS</b>
Identify Your Customer Segments and Early Adopters The difference between a consumer and a customer (decision maker); Market Types, Segmentation and Targeting, Defining the personas; Understanding Early Adopters and Customer Adoption Patterns. Identify the innovators and early adopters for your startup.Craft Your Value Proposition Come up with creative solutions for the identified problems Deep dive into Gains, Pains and "Jobs-To-Be-Done" (using Value Proposition Canvas, or VPC) Identify the UVP of your solution using the Value Proposition section of the VPC Outcome-Driven InnovationClass Presentation: Communicating the Value Proposition- 1 min Customer Pitch		
<b>PRACTICAL NO.04</b>	<b>BUSINESS MODEL</b>	<b>4 HOURS</b>
Get Started with Lean Canvas Basics of Lean Approach and Canvas; Types of Business Models (b2b; b2c)		
<b>PRACTICAL NO.05</b>	<b>VALIDATION</b>	<b>9 HOURS</b>
Develop the Solution Demo Build solution (mockups) demo, How to run solution interviews, GOOTB: Run Solution interviews. Does your solution solve the problem for your customers: The problem-solution test. Sizing the Opportunity Differences between a Startup venture and a small business; Industry Analysis Understanding what is Competition and it's role, Analyze competition Case study: Blue Ocean Strategy Building an MVP Identify an MVP and build it - I; Document and validate your assumptions Build-Measure-Learn feedback loop and the MVP/Javelin Board How to do MVP Interviews GOOTB: Run MVP interviews Is there a market for your product –The product-market fit test Class Presentation: Present your MVP		
<b>PRACTICAL NO.06</b>	<b>MONEY</b>	<b>5 HOURS</b>
Revenue Streams Basics of how companies make money. Understand income, costs, gross and net margins. Identify primary and secondary revenue streams. Pricing and Costs Value, price, and costs; Different pricing strategies. Understand product costs and operations costs; Basics of unit costing Financing Your New Venture How to finance business ideas, Various sources of funds available to an entrepreneur and pros and cons of each, What investors expect from you, Practice Pitching to Investors and Corporates.		



<b>PRACTICAL NO.07</b>	<b>TEAM</b>	<b>2 HOURS</b>
<p>Team Building Shared Leadership Role of a good team in a venture's success; What to look for in a team; How do you ensure there is a good fit? Defining clear roles and responsibilities. How to pitch to candidates to join your startup Explore collaboration tools and techniques - Brainstorming, Mind mapping, Kanban Board, #Slack.</p>		
<b>PRACTICAL NO.08</b>	<b>MARKETING &amp; SALES</b>	<b>2 HOURS</b>
<p>Positioning Understand the difference between product and brand and the link between them. Define the positioning statement for your product/service and how it should translate into what your customers should see about that brand in the marketplace. Channels &amp; Strategy Building Digital Presence and leveraging Social media, Creating your company profile page, Measuring the effectiveness of selected channels, Budgeting and planning. Sales Planning Understanding why customers buy and how buying decisions are made; Listening. Sales planning, setting targets. Unique Sales Proposition (USP); Art of the sales pitch (focus on customers needs, not on product features) Follow-up and closing a sale; Asking for the sale.</p>		
<b>PRACTICAL NO.09</b>	<b>SUPPORT</b>	<b>2 HOURS</b>
<p>Planning &amp; Tracking Importance of project management to launch and track progress Understanding time management, workflow, and delegation of tasks Business Regulation Basics of business regulations of starting and operating a business; Importance of being compliant and keeping proper documentation How to find help to get started</p>		
<b>PRACTICAL NO.10</b>	<b>Capstone Project: Present Your BMC (Optional - and MVP)</b>	<b>2 HOURS</b>
<p>BMC: Business Model Canvas. / MVP: Minimum Viable Product.</p>		

## REFERENCES

1. Read Forbes article and do Group Discussion <https://www.forbes.com/sites/chrismyers/2015/12/16/find-your-flow-and-success-will-follow/>
2. <https://necrophone.com/2014/01/20/effectuation-the-best-theory-of-entrepreneurship-you-actually-follow-whether-youve-heard-of-it-or-not/>
3. Use your self awareness to find out what motivates and drives Entrepreneurial activity - Ted Talk "What is your Entrepreneurial style - EntrepreneurKnow
4. Prof. Clay Christensen "Identifying Customer Needs" <https://www.youtube.com/watch?v=yVCZ-7xSsCw>
5. "Understand the customer problem by GOOTB":by GOOTB":<https://www.youtube.com/watch?v=sEENIZgscDw>
6. <https://www.forbes.com/sites/danschawbel/2013/12/17/geoffrey-moore-why-crossing-the-chasm-is-still-relevant>
7. Value Proposition: <https://www.youtube.com/watch?v=jZN6CUieuOQ&list=PLw540Wq5kay866m6A6xI7KOWEAh7is4m>
8. Value Proposition & Customer Need:<https://www.youtube.com/watch?v=6FnG8pJL8yM&index=3&list=PLw540Wq5kay866m6A6xI7KOWEAh7is4m>
9. <https://strategyn.com/turn-customer-input-into-innovation/> CASE STUDIES in ODI:  
<https://jobs-to-be-done.com/tagged/case-study>
10. TheLeanBMC <https://www.youtube.com/watch?v=FjBe7UO1hc>
11. Ash Maurya -Capture your BMC in 20
12. minutes <https://www.youtube.com/watch?v=7o8uYdUaFR4&t=462s>
13. Ash Maurya - How to Prioritize Risks on Your Business Model  
<https://www.youtube.com/watch?v=01z7EPXS42k>
14. <https://pt.slideshare.net/bmorelean/dan-lemborg-lean-pitch>
15. <https://startups.fb.com/en-in/categories/development/>
16. Designing Experiments: <https://www.youtube.com/watch?v=WiMZWCG1Hu8&t=111s>
17. Customer Development Process:<https://www.youtube.com/watch?v=ILEebbiYIkI>
18. Beating the Competition: <https://www.youtube.com/watch?v=46uP6vOj5G0>
19. Q&A with Garr :<https://www.youtube.com/watch?v=SmJjOrusyI>
20. Basic Accounting Lingo for Entrepreneurs:<https://www.youtube.com/watch?v=Y7Pm1jEEKE>
21. Vinod Khosla : How Leaders can BUILD <https://www.youtube.com/watch?v=bRC0BgCn1Q>
22. Vinod Khosla: <https://www.youtube.com/watch?v=VlRNLzTs9cw>
23. How to Pitch the way VC's think, so you can convince co-founders :  
<https://www.youtube.com/watch?v=fTgU7THoKCw>
24. Tony Buzan:<http://www.tonybuzan.com/about/mind-mapping/>
25. Google : Think branding:<https://www.youtube.com/watch?v=1l2CUjkg0ug>
26. The Battle for your mind using Positioning:<https://www.youtube.com/watch?v=jQrY8xRx-0>  
Design rules-<https://www.igorinternational.com/>, Web design course:<https://www.coursera.org/specializations/web-design>  
Strikingly Free :  
<https://www.strikingly.com/online-resume/linkedin>
27. <https://certification.hubspot.com/inbound-sales-certification-course>
28. <https://www.udemy.com/courses/business/sales/>
29. <https://www.accountingtools.com/articles/2017/5/17/sales-budget-sales-budget-example>

 <b>Academy of Engineering</b> (An Autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2018 - 2019</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>	Professional Skills
		<b>COURSE CODE</b>	HP 302
		<b>COURSE CREDITS</b>	2
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
1	2	NIL	NIL	NIL	50	25	75

**PRE-REQUISITE :** Basic Communication Skills

**COURSE OBJECTIVES :**

HP302.CEO.1: To define the importance of professional skills in student's life  
 HP302.CEO.2: To explain them necessary, specific professional skills  
 HP302.CEO.3: To appraise students for placements through acquisition of professional skills  
 HP302.CEO.4: To support them detect their present level in respect of each professional skill and show direction for improvement


**COURSE OUTCOMES :**

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

HP302.CO.1: Relate the importance of professional skills(L2)  
 HP302.CO.2: Build necessary, specific professional skills (L3)  
 HP302.CO.3: Analyze the environment of employ-ability (L4)  
 HP302.CO.4: Develop various techniques of effective team building in their professional life(L6)

<b>PRACTICALS: (SECTION A)</b>		
<b>PRACTICAL NO.01</b>	<b>Self Awareness</b>	<b>2 HOURS</b>
Concept of Johari Window, Advantages and disadvantages of every quadrant, Identifying the proportion of each quadrant in respect of self, Using the tools of 'Feedback' & 'Exposure' for self-development		
<b>PRACTICAL NO.02</b>	<b>Personal Interviews</b>	<b>6 HOURS</b>
Preparing for Interviews, Typical expected questions & suggested responses, Posture, Body language, Greetings and pleasantries, , Handling unforeseen questions		
<b>PRACTICAL NO.03</b>	<b>Group Discussion</b>	<b>4 HOURS</b>
Parameters of assessment, Initiating the discussion, Effective listening, Own contribution, Paraphrasing, Arguing and counter-arguing, Giving direction to the discussion		
<b>PRACTICAL NO.04</b>	<b>Team building and Motivation</b>	<b>2 HOURS</b>
Hallmark of effective teams, Barriers to team work, Subjugation of Individual interests for achievement of team's goal, Leading & motivating team members		
<b>PRACTICAL NO.05</b>	<b>Innovative Thinking</b>	<b>2 HOURS</b>
Relevance and importance of innovative thinking, Introduction to Brain Storming technique, Collective and individual Brain Storming,		
<b>PRACTICAL NO.06</b>	<b>Decision Making</b>	<b>2 HOURS</b>
Levels of decisions, Process of decision-making, Types of criteria, Individual and collective decision-making, Barriers in decision making, Keys to sound decision-making		
<b>SECTION B:</b>	<b>Aptitude Training.</b>	

<b>REFERENCE BOOK</b>
1. Stephen Covey: The Seven Habits of Highly Effective People, Simon and Schuster Ltd, ISBN: 0-671-71117-2
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.

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>THIRD YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Mini Project
		<b>COURSE CODE</b>	ME324
		<b>COURSE CREDITS</b>	2
<b>RELEASED DATE : 01/06/2018</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			PRACTICAL/ TERMWORK	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE		MSE	ESE	IA			
-	4	-	-	-	-	75	75

**PRE-REQUISITE :** Minor Project

**COURSE OBJECTIVES :**

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ME324.CEO.1: To understand the Product Development Cycle through Mini project.  
 ME324.CEO.2: To undertake & execute a mini Project through a group of students  
 ME324.CEO.3: To inculcate skills in engineering product design and development process, budgeting, Planning, testing, effective trouble-shooting practices, aesthetics and ergonomics.  
 ME324.CEO.4: To understand the role of professional and ethical practices, management principles, Technical documentation and communication skills in engineering.

**COURSE OUTCOMES :**

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

ME324.CO1: Execute an idea in a team as well as within constraints.  
 ME324.CO2: Acquire knowledge of the techniques, skills and modern engineering tools necessary for engineering practices.  
 ME324.CO3: Use standard engineering tools and processes for design, simulation, testing, analysis in implementation and deployment of theoretical idea into practice.  
 ME324.CO4: Use standard documentation and presentation tools for a professional report and presentation of the work.

**PREAMBLE:**

The main objective of this course is to understand the Product Development Cycle through mini Project, Where students will undertake & execute a project through a group of students. They will plan for various activities of the project and distribute the work amongst team members. The students will learn budgeting, planning for the project, engineering skills and processes, testing and effective troubleshooting practices, safety norms and standards, significance of aesthetics & ergonomics while designing a product. This course will develop students abilities to transmit technical information clearly and delivery of presentation based on the Mini Project. They will understand the importance of document design standards by compiling technical report on the mini Project work carried out in a team.

**PRACTICAL**

<b>Stage- 1</b>	<b>Formation of group and Allocation of project adviser</b>	<b>Week 1</b>
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- Project group formation and project advisor allocation by the department
- Project group shall consist of Minimum 02 and maximum 03 students per group (For detailed process please check Annexure-1 Mini project guidelines)
- Selection of finalized topic from approved project topics by the department.
- The project design idea shall be based on refereed papers, white papers, product, patent, application notes, industry problem, academic, institute or societal requirement, funded research, innovative thought, modification/ development in existing idea etc.
- Each student will maintain a logbook/project diary. This diary will be utilized to monitor project progress throughout

<b>Stage- 2</b>	<b>Project Review -1 Internal review by project adviser</b>	<b>Week-2,3</b>
<ul style="list-style-type: none"> <li>• The project group will work on , <ol style="list-style-type: none"> <li>1. Conceptualization of an Idea</li> <li>2. Literature review</li> <li>3. Market survey</li> <li>4. Finalizing the Specificationsy</li> </ol> </li> <li>• Presentation of work progress to project adviser and proceed to project approval.</li> </ul>		
<b>Stage- 3</b>	<b>Project Review -2 Project Approval</b>	<b>Week-4</b>
<ul style="list-style-type: none"> <li>• Presentation of concept to Department Review Committee (DRC) or Committee appointed by department.</li> <li>• Review of concept and feasibility of project and necessary suggestions for implementation by the committee</li> <li>• The project group will make corrections and continue their work.</li> </ul>		
<b>Stage- 4</b>	<b>Project Review -3 Internal review by project adviser</b>	<b>Week-5,6,7,8,9</b>
<ul style="list-style-type: none"> <li>• The project group will work on , <ol style="list-style-type: none"> <li>1. System Architecture and Design</li> <li>2. Simulation /software development (As applicable)</li> <li>3. Manufacturing of project</li> <li>4. Assembly</li> <li>5. Testing</li> <li>6. Troubleshooting</li> </ol> </li> <li>• Presentation of work progress to project adviser and proceed to final project progress review.</li> </ul>		

Stage- 5	Project Review -4 Final Project progress review	Week-10,11
<p><b>The project group will work on</b></p> <ol style="list-style-type: none"> <li>1. Result analysis against specifications</li> <li>2. Enclosure/Aesthetic design (As applicable)</li> <li>3. Technical report generation (Draft copy)</li> <li>4. User’s manual (As applicable)</li> <li>5. Bill of material etc.</li> </ol> <p><b>The technical report may incorporate following points,</b></p> <ol style="list-style-type: none"> <li>1. Title</li> <li>2. Introduction and Concept</li> <li>3. Literature &amp; Market survey</li> <li>4. Theory and relevance</li> <li>5. Block diagram</li> <li>6. Drawings (As applicable)</li> <li>7. Specifications</li> <li>8. Project plan</li> <li>9. Bill of material</li> <li>10. Enclosure/aesthetic design (As applicable)</li> <li>11. Results</li> <li>12. Results analysis</li> <li>13. Conclusion</li> <li>14. References</li> </ol> <ul style="list-style-type: none"> <li>• Presentation of project work, draft copy of technical report , Final presentation etc. to DRC or Committee appointed by department.</li> <li>• Review of project progress and necessary suggestions by DRC or Committee appointed by department for final presentation.</li> <li>• The project group will make corrections. After clearing all comments from DRC; project can be presented to final l examination.</li> <li>• Project must be approved by department to appear for final examination.</li> </ul>		



Practical- 6	Examination: Final Demonstration and presentation	Week-12
<ul style="list-style-type: none"> <li>● Final examination will be divided in three parts               <ol style="list-style-type: none"> <li>1. Demonstration</li> <li>2. Presentation</li> <li>3. Project documentation</li> </ol> </li> <li>● For final examination project must be demonstrated in front of examiner panel. For Industry sponsored projects or other installations examiner panel can visit the project venue.</li> <li>● All students must be physically present in front of examiner panel at the time of examination.</li> <li>● Only demonstrated projects can be evaluated for presentation and documentation.</li> <li>● Mini Project demonstration: Demo of project works and validation of project results to examiners panel.</li> <li>● Mini Project presentation: Presentation of overall project work form project idea to implementation and deployment of project to examiners panel.</li> <li>● Mini Project documentation: Presentation of technical documentary report to examiners panel</li> </ul>		

<p><b>Assessment:</b></p> <hr/>
<p><b>Internal Assessment:</b></p>
<ol style="list-style-type: none"> <li>1. Project Review -2 Project Approval -05 Marks</li> <li>2. Project Review -3 Internal review by project adviser- -05 Marks</li> <li>3. Project Review -4 Final Project progress review- 10 Marks</li> </ol>
<p><b>Examination: Final Demonstration and presentation</b></p>
<ol style="list-style-type: none"> <li>1. Mini Project demonstration: 20 Marks</li> <li>2. Mini Project presentation: 20 Marks</li> <li>3. Mini Project documentation: 15 Marks</li> </ol>



**MIT ACADEMY OF ENGINEERING, ALANDI**

**An Autonomous Institute Affiliated to**

**Savitribai Phule Pune University**

**Curriculum**

**For**

**Final Year**

**Bachelor of Technology in  
Mechanical Engineering**

**2016-2020**

**(With Effect from Academic Year: 2019-2020)**

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**SCHOOL OF MECHANICAL & CIVIL  
ENGINEERING**

**W. E. F : 2019-20**

**FINAL YEAR BACHELOR OF  
TECHNOLOGY  
MECHANICAL ENGINEERING**

**RELEASE DATE : 01/12/2018**

**REVISION NO. : 0.0**

**SEMESTER: VII**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC11	ME401	Heating Ventilation & Air Conditioning	3	2	4
2.	DE1	ME41#	Discipline Elective - Refer Annexure.	3	--	3
3.	OE3	ME42#	Open Elective - Refer Annexure.	3	2	4
4.	HSS7	HP402	Sociology	2	--	2
5.	HSS8/ SDP7	HP403/ ME40#	Business Strategies / Piping Design/ Six Sigma/ Energy Audit	--	2	1
6.	SDP8	ME402	Project - I	--	8	4
7.	SDP9	ME404	Summer Internship	--	--	4
<b>TOTAL</b>				11	14	22

**SEMESTER: VIII**


SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC12	ME431	Noise Vibration & Harshness	3	2	4
2.	DE2	ME44#	Discipline Elective - Refer Annexure	3	--	3
3.	OE4	ME45#	Open Elective - Refer Annexure	3	2	4
4.	HSS9	HP401	Engineering Economics	2	--	2
5.	SDP10	ME432	Project - II	--	8	4
<b>TOTAL</b>				11	12	17

*L: Lecture, P: Practical*

<b>Open Elective (OE): 4 Courses</b>			
	<b>Sl. No.</b>	<b>Course Code</b>	<b>Name of Course</b>
Computer Aided Engineering	1.	ME311	Geometric Modeling & Design
	2.	ME331	Finite Element Analysis
	3.	ME421	Computational Fluid Dynamics
	4.	ME451	Advanced Engineering Analysis
Robotics & Automation	1.	ME312	Fundamentals of Robotics
	2.	ME332	Kinematics & Dynamics of Robots
	3.	ME422	Robotics Vision and Control
	4.	ME452	Intelligent and High Performance Robotics
Industrial Engineering & Management	1.	ME313	Work Process Assessment
	2.	ME333	Facility Planning & Design
	3.	ME423	Operations Management
	4.	ME453	Supply Chain Management

<b>Department Elective (DE): 2 Courses</b>		
	<b>Course Code</b>	<b>Name of Course</b>
1.	ME411	Mechatronics
	ME412	Pressure Vessel Design
	ME413	Power Plant Engineering
	ME414	Product Lifecycle Management
2.	ME441	Hydraulics & Pneumatics
	ME442	Mechanical System Design
	ME443	Non-Conventional Machining
	ME444	Enterprise Resource Planning

<b>Skill Development and Project (SDP): 10 Courses</b>		
<b>Sl. No.</b>	<b>Course Code</b>	<b>Name of Course</b>
1.	ME102	Engineering Tools and Techniques
2.	ME103	Design Thinking
3.	ET206	Prototyping
4.	ME213	Minor Project
5.	ME304	Skill Development Lab (Autodesk Inventor)
	ME305	Skill Development Lab (CATIA)
6.	ME403	Piping Design
	ME404	Six Sigma
	ME405	Energy Audit
7.	ME324	Mini Project
8.	ME402	Project - I
9.	ME406	Summer Internship
10.	ME432	Project - II

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY</b> <b>MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Heating Ventilation & Air Conditioning
		<b>COURSE CODE</b>	ME401
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	50	-	150

**PRE-REQUISITE :** Heat Transfer

**COURSE OBJECTIVES :**

ME401.CEO.1: To impart working and operating principles of Air Refrigeration, Vapor compression and Vapor Absorption system.

ME401.CEO.2: To apply concepts of air-conditioning cycles in developing energy efficient cooling systems.

ME401.CEO.3: To expose students to various HVAC controls and applications of Refrigeration, Heating Ventilation and Air-conditioning.

**COURSE OUTCOMES :**

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

ME401.CO.1: Apply fundamental principles of refrigeration cycles used in air conditioning and refrigeration systems. (L3)

ME401.CO.2: Discuss various properties of refrigerants and its impact on environment.(L2)

ME401.CO.3: Read psychometric chart to solve commercial cooling and heating problems. (L4)

ME401.CO.4: Manage to construct and design HVAC systems (L3)

ME401.CO.5: Explain various air conditioning systems and its components.(L3)

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Fundamentals of Refrigeration</b>	<b>8 HOURS</b>
First and Second Law applied to refrigerating machines, Reverse Carnot cycle, Carnot refrigerator, Carnot heat pump, unit of refrigeration, Co-efficient of Performance, Energy Efficiency Ratio (EER), and BEE star rating. Air refrigeration systems: Bell Coleman cycle, applications Application of refrigeration system.		
<b>UNIT 2</b>	<b>Refrigeration Cycles, components and refrigerants</b>	<b>10 HOURS</b>
Simple vapour compression cycle, Effect of liquid sub cooling & superheating, effect of evaporator and condenser pressures, methods of sub cooling, use of P-h charts, Actual VCR cycle, Use of p -h Charts, Comparison between air-cooled and water-cooled condenser based air conditioning systems. Components: Types of condensers, evaporators, expansion devices, compressors and cooling tower Refrigerants: Desirable properties of refrigerants, ASHRAE numbering system for refrigerants. Thermodynamic, Chemical and Physical properties, Secondary refrigerants, ODP and GWP, Montreal protocol and India's commitment, Recent substitutes for refrigerants.		
<b>UNIT 3</b>	<b>Psychrometry</b>	<b>6 HOURS</b>
Need for air conditioning, Principle of Psychrometry, Psychrometric properties, chart and processes, air washers, requirements of comfort air conditioning, summer and winter air conditioning		
<b>UNIT 4</b>	<b>Design of Air Conditioning Systems</b>	<b>10 HOURS</b>
Different Heat sources, Adiabatic mixing of two air streams, Bypass factor, sensible heat factor, RSHF, GSHF, ERSHF, Room apparatus dew point and coil apparatus dew point, Ventilation and Infiltration, Inside and Outside Design condition, Cooling Load estimation. Introduction to Unitary Products viz. Room/Split and Packaged Air Conditioners, Introduction to recent developments viz. Variable Refrigerant Flow systems, VAV control systems, Inverter Units.		
<b>UNIT 5</b>	<b>Design of Duct, Ventilation and Exhaust system</b>	<b>6 HOURS</b>
Duct Design Friction chart for circular ducts, Equivalent diameter of a circular duct for rectangular Ducts, Static pressure regain, and equal pressure drop methods of duct design. Factors considered in air distribution system, Air distribution systems for cooling and heating. Types of ventilation system and its design, Types of exhaust system.		
<b>UNIT 6</b>	<b>New trends in the Build environment, Controls and Non-Conventional Refrigeration Systems</b>	<b>4 HOURS</b>
Vapour Absorption Refrigeration – NH <sub>3</sub> – Water Vapour Absorption system, Heat pump, Green Buildings, Net zero and Net positive Buildings, Systems Indoor Air Quality (IAQ), BMS Smart building. Human Comfort, Thermal exchange of body with environment, Effective temperature, Comfort chart, Comfort zone, Controls– LP/HP cutoff, Thermostats, Humidistat, Interlocking control, Electronic Controllers. Thermoelectric Refrigeration, Thermo-acoustic Refrigeration, Vortex Tube Refrigeration		

<b>PRACTICAL: Perform the following experiments.</b>		
<b>PRACTICAL NO.01</b>		<b>2 HOURS</b>
Test on Vapour Compression cycle test rig		
<b>PRACTICAL NO.02</b>		<b>2 HOURS</b>
Test on Vapour absorption cycle test rig		
<b>PRACTICAL NO.03</b>		<b>2 HOURS</b>
Test on Ice plant test rig		
<b>PRACTICAL NO.04</b>		<b>2 HOURS</b>
Test on air conditioning test rig		
<b>PRACTICAL NO.05</b>		<b>2 HOURS</b>
Test on Heat pump		
<b>PRACTICAL NO.06</b>		<b>2 HOURS</b>
Case study on Domestic Refrigerator		
<b>PRACTICAL NO.07</b>		<b>2 HOURS</b>
Estimation of cooling load of simple air conditioning system		
<b>PRACTICAL NO.08</b>		<b>2 HOURS</b>
Case study on cold storage		
<b>PRACTICAL NO.09</b>		<b>2 HOURS</b>
Thermal analysis of refrigeration cycle using suitable software		
<b>PRACTICAL NO.10</b>		<b>6 HOURS</b>
Visit to air conditioning plant/Cold storage is compulsory.		


<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. C. P. Arora, "Refrigeration and air-conditioning", Tata McGraw-Hill Education, 2nd Edition, 2000 ISBN -0- 07-463010-5</li> <li>2. R. J. Dossat, Principles of refrigeration, Willey Eastern Publication, 4th Edition, 2007, ISBN: 9788177588811, 8177588818</li> <li>3. P. Ananthanarayana, Basic Refrigeration and air-conditioning, McGraw-Hill Education, 4th Edition, 2003, ISBN: 9781259062704, 1259062708</li> </ol>



## REFERENCE BOOK

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1. Manohar Prasad, Refrigeration and air-conditioning, New Age International Publishers, 2nd Edition, 2000 ISBN: 9788122436945, 8122436943
2. W F Stoeker and J W Jones, Refrigeration and air-conditioning, McGraw-Hill Education, 2nd Edition ISBN: 9789332902954, 933290295X
3. ASHRAE Handbook of Fundamentals
4. ASHRAE Handbook of Systems
5. ASHRAE Handbook of Equipment
6. ASHRAE Air Conditioning Handbook
7. ASHRAE Refrigeration Handbook

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>		<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>		Mechatronics
		<b>COURSE CODE</b>		ME411
		<b>COURSE CREDITS</b>		3
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
3	-	30	40	30	-	-	100

**PRE-REQUISITE :** Electrical & Electronics Engineering

**COURSE OBJECTIVES :**

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ME411.CEO.1: To describe mechatronics system and its key elements, Representation of systems in block diagram.

ME411.CEO.2: To describe concept of signal processing and interfacing.

ME411.CEO.3: To understand sensors and their characteristics for its applications.

ME411.CEO.4: Describe actuators with classification and application.

ME411.CEO.5: Implementation of Programming by any controller.

**COURSE OUTCOMES :**

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

ME411.CO.1: Identification of key elements of mechatronics system and its representation in terms of block Diagrams.

ME411.CO.2: Apply the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O.

ME411.CO.3: Select the sensors and interfacing with DAQ.

ME411.CO.4: Choose the actuator based on application.

ME411.CO.5: Program to control sensor and actuators.


<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction to Sensors</b>	<b>8 HOURS</b>
Introduction to Mechatronics, Measurement characteristics: - Static and Dynamic Sensors: Position Sensors: - Potentiometer, LVDT, Encoders; Proximity sensors: - Optical, Inductive, Capacitive; Motion Sensors: - Variable Reluctance; Temperature Sensor: RTD, Thermocouples; Force / Pressure Sensors: - Strain gauges; Flow sensors: - Electromagnetic		
<b>UNIT 2</b>	<b>Block Diagram Representation</b>	<b>6 HOURS</b>
Open and Closed loop control system, identification of key elements of mechatronics systems and represent into block diagram (Electro-Mechanical Systems), Concept of transfer function, Block diagram reduction principles, problems on reduction of block diagram Applications of mechatronics systems: - Household, Automotive, Shop floor (industrial).		
<b>UNIT 3</b>	<b>Data Acquisition &amp; Microcontroller System</b>	<b>8 HOURS</b>
Interfacing of Sensors / Actuators to DAQ system, Bit width, Sampling theorem, Aliasing, Sample and hold circuit, Sampling frequency, ADC (Successive Approximation), DAC (R-2R), numerical on data conversion, Current and voltage Amplifier.		
<b>UNIT 4</b>	<b>Introduction to Robotic System</b>	<b>6 HOURS</b>
Introductions of robots, Classification of robots based on Physical configuration, Mechanism in robotic system, Structure and application of robots, Machine learning.		
<b>UNIT 5</b>	<b>Actuators</b>	<b>6 HOURS</b>
Classification of actuators: Electrical Drives, Pneumatic Drives, Hydraulic drives, Other special application drives. Grippers and end effectors. selection of motors based on application with force/power/torque requirement.		
<b>UNIT 6</b>	<b>Controllers and programming</b>	<b>6 HOURS</b>
Programming for reading Analog data, Digital data. Controlling Motor by PWM. Servo Motor control, Stepper motor control, BLDC motor control, Development boards.		

<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. K.P. Ramchandran, G.K. Vijayaraghavan, M.S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Willey Publication, 2008, ISBN-13: 978-8126518371</li> <li>2. Bolton, Mechatronics - A Multidisciplinary approach, 4th Edition, Prentice Hall, 2009, ISBN-10: 0132407639</li> </ol>

## REFERENCE BOOK

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1. Alciatore & Histan, Introduction to Mechatronics and Measurement system, 4th Edition, McGraw Hill publication, 2011, ISBN: 978-0071254076
2. Bishop (Editor), Mechatronics – An Introduction, CRC Press, 2006, ISBN 9780849363580
3. Mahalik, Mechatronics – Principles, concepts and applications, Tata Mc-Graw Hill publication, New Delhi, ISBN: 9780070483743
4. C. D. Johnson, Process Control Instrumentation Technology, Prentice Hall, New Delhi, ISBN-13: 978-0131194571

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY</b> <b>MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Pressure Vessel Design
		<b>COURSE CODE</b>	ME412
		<b>COURSE CREDITS</b>	3
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	-	-	100

**PRE-REQUISITE :** Machine Design

**COURSE OBJECTIVES :**

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ME412.CEO.1: To aware of IS2825 standards for pressure vessel design and materials.

ME412.CEO.2: Perform elementary design calculations using ASME Code formulas to determine wall thicknesses.

ME412.CEO.3: Understand the various welding processes used in today's fabrication facilities.

ME412.CEO.4: Estimate stresses due to structural and temperature loads in pressure vessel components.

ME412.CEO.5: Master the design and calculation of horizontal storage vessels, get familiar with the basic structures of horizontal and spherical storage vessels.

**COURSE OUTCOMES :**

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

ME412.CO.1: Understand and explain all calculations used by the Code and relate them to fundamental principle.

ME412.CO.2: Explain and apply the fundamental principles of loads and stresses as applied to pressure vessels.

ME412.CO.3: Identify the different types of stresses and their effects on pressure vessel.

ME412.CO.4: Verify the testing and failures of design vessels under thermal and fatigue load.


ME412.CO.5: Design shells, end closures and nozzles of pressure vessels using ASME codes.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Process Design Parameters</b>	<b>8 HOURS</b>
Basic concepts in process design, block diagrams for flow of Processes, material flow balance. Design pressures –temperatures, design stresses, factory of safety, minimum shell thickness and corrosion allowance, weld joints efficiency, design loading, stress concentration and thermal stresses, failure criteria, optimization technique such as Lagrange’s multiplier and golden section method, cost and profitability estimation. Introduction to design codes like IS-2825, ASME-SECT, EIGHT-DIV-II TEMA.API-650, BS-1500 & 1515.		
<b>UNIT 2</b>	<b>Stresses in Pressure Vessels</b>	<b>8 HOURS</b>
General theory of membrane stresses in vessel under internal pressure and its application to shells (cylindrical, conical and spherical) and end closures. Bending of circular plates and determination of stresses in simply supported and clamped circular plate. Thermal stresses, Stress concentration in plate having circular hole due to bi-axial loading, Excessive elastic deformation, Plastic instability, Brittle rupture and creep. Theory of reinforced opening and reinforcement limits.		
<b>UNIT 3</b>	<b>Design of Cylindrical and Spherical Vessels</b>	<b>8 HOURS</b>
Thin and thick-walled cylinder analysis, design of end closers, local stresses due to discontinuity or change of shape of vessel, vessel opening compensation, design of standard and non-standard flanges, design of vessels and pipes under external pressure, design of supports for process vessels.		
<b>UNIT 4</b>	<b>Supports for vertical &amp; horizontal vessels</b>	<b>4 HOURS</b>
Design of base plate and support lugs. Types of anchor bolt, its material and allowable stresses. Design of saddle supports.		
<b>UNIT 5</b>	<b>Design of Vessels using Codes</b>	<b>8 HOURS</b>
Introduction to ASME codes for pressure vessel design, Pressure vessel and related components’ design using ASME codes; Supports for short vertical vessels, Stress concentration at a variable thickness transition section in a cylindrical vessel; Design of nozzles.		
<b>UNIT 6</b>	<b>Other Design Considerations</b>	<b>8 HOURS</b>
Buckling phenomenon, Elastic Buckling of circular ring and cylinders under external pressure, collapse of thick-walled cylinders or tubes under external pressure, Effect of supports on Elastic Buckling of Cylinders, Design of circumferential stiffeners, Buckling under combined External pressure and Axial loading. Fatigue, shock, high pressure, high temperature, irradiation, corrosion, and other hostile environments; High strength, lightweight pressure vessels, Vessels resistant to external high pressures found in undersea exploration, offshore drilling, and mineral mining.		
<b>TEXT BOOK</b>		
<ol style="list-style-type: none"> <li>1. Pressure Vessels: Design and Practice by Somnath Chattopadhyay; CRC Press, ISBN-13: 978-0849313691</li> <li>2. Harvey J F, Pressure vessel design, CBS Publication, ISBN-13: 978-8123910413</li> <li>3. Henry H. Bedner, Pressure Vessels, Design Hand Book, CBS publishers and Distributors,1987, ISBN-13: 978-0894645037</li> </ol>		

## REFERENCE BOOK

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1. Brownell L. E and Young. E. D, Process equipment design, Wiley Eastern Ltd., India, ISBN-13: 978-0849313691
2. ASME Pressure Vessel and Boiler code, Section VIII Div. 1, 2, and 3, ASME, American standard code for pressure piping, B 31.1, ASME, ISBN-13: 978-0849313691
3. Henry H Bednar, Pressure vessel Design Hand book, CBS publishers and distributors
4. Stanley M Wales, Chemical Process Equipment, Selection and Design, Butterworths, Series in Chemical Engineering, 1988. Elsevier, ISBN-13: 978-0894645037
5. J. Phillip Ellenberger, Pressure Vessels: ASME Code Simplified, ASME.

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>			<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>			<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>			<b>COURSE NAME</b>		Power Plant Engineering
			<b>COURSE CODE</b>		ME413
			<b>COURSE CREDITS</b>		3
<b>RELEASED DATE : 01/01/2019</b>			<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
3	-	30	40	30	-	-	100

**PRE-REQUISITE :** Turbomachines

**COURSE OBJECTIVES :**

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ME413.CEO.1: To apply principles/ methods related to Thermodynamics and Turbomachinery  
 ME413.CEO.2: Understand the different power generation methods, its economics and global energy situation  
 ME413.CEO.3: To impart a knowledge about the design of green power system.

**COURSE OUTCOMES :**


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

ME413.CO.1: Recall fundamentals of Thermal Engineering  
 ME413.CO.2: Evaluate different types of power plant  
 ME413.CO.3: Experiment verification of basic concept.  
 ME413.CO.4: Analyze the load calculation for any system.  
 ME413.CO.5: Investigate the methods to reduce pollution from power plants.  
 ME413.CO.6: Design a simple power plant according to need.



<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Thermal Power Plant</b>	<b>8 HOURS</b>
Working of the thermal power plant, FBC boilers, High-pressure boilers (Supercritical and Ultra Super-critical), Rankine cycle with reheat and regeneration, cogeneration power plant (Numerical), condenser and cooling tower, coal classification, coal and ash handling, Methods to reduce the pollution from the thermal power plant.		
<b>UNIT 2</b>	<b>Hydro-electric power plant</b>	<b>6 HOURS</b>
Classification, layout, components and auxiliaries of hydropower plant, Selection of turbines, micro-hydro plants, pumped storage, flow duration curve, mass curve		
<b>UNIT 3</b>	<b>Nuclear power plant</b>	<b>8 HOURS</b>
Evolution of nuclear energy from atoms by fission and fusion, chain reaction, Fission material, Components of a nuclear reactor, Classification of reactors, Pressurized water reactor, Boiling water reactor, Gas-cooled reactor, CANDU reactor, Fast breeder reactor, Nuclear waste and its disposal, Nuclear power plants in India		
<b>UNIT 4</b>	<b>Gas turbine power plant</b>	<b>8 HOURS</b>
Classification, open and closed cycle, gas turbine fuels, actual Brayton cycle, optimum pressure ratio for maximum thermal efficiency, work ratio, air rate, effect of operating variables on the thermal efficiency and work ratio and air rate, combined steam and gas turbine plant, gas turbine blade cooling The diesel-electric power plant, a different system of diesel power plant.		
<b>UNIT 5</b>	<b>Non-conventional power plant</b>	<b>6 HOURS</b>
Wind resource assessment, types and selection of wind turbines; operation and control of machines; Solar PV power plants: system components, selection criteria; Solar Thermal Power Plants: Types of solar thermal plants, component description, the auxiliary heating requirement		
<b>UNIT 6</b>	<b>Economic Analysis of Power Plants</b>	<b>6 HOURS</b>
Load curves, Load duration curves, Connected load, Maximum load, Peak load, Base load and peak load power plants, Load factor, Plant capacity factor, Plant use factor, Demand factor, Diversity factor, Cost of the power plant, Tariff for electric energy, Comparison of power plants. Power plant- Global scenario, Indian scenario, Maharashtra scenario, Environmental Aspects.		
<b>REFERENCE BOOK</b>		
<ol style="list-style-type: none"> <li>1. Power Plant Engineering, P.K. Nag, McGraw-Hill Education, ISBN 0070435995</li> <li>2. Power Plant Technology, M.M. El-Wakil, McGraw-Hill Education, ISBN 978007072448</li> <li>3. Thermal Engineering, R. K. Rajput, Laxmi Publication, ISBN 9788131808047</li> <li>4. Gas Turbines by V Ganeshan, McGraw Hill Education, ISBN 0070435995</li> </ol>		

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>	<b>COURSE SYLLABI (2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Product Lifecycle Management
		<b>COURSE CODE</b>	ME414
		<b>COURSE CREDITS</b>	3
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	Nil	30	40	30	Nil	Nil	100

**PRE-REQUISITE :** Design Thinking, Prototype

**COURSE OBJECTIVES :**

ME414.CEO.1: To familiarize the students with the need, benefits and components of PLM.  
 ME414.CEO.2: To acquaint students with Product Data Management & PLM strategies.  
 ME414.CEO.3: To give insights into new product development program and guidelines for designing and developing a product.  
 ME414.CEO.4: To familiarize the students with Virtual Product Development.  
 ME414.CEO.5: To familiarize the students with life cycle environmental strategies and project management schedule.

**COURSE OUTCOMES :**

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

ME414.CO.1: Recall the knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.  
 ME414.CO.2: Illustrate various approaches and techniques for designing and developing products.  
 ME414.CO.3: Apply product engineering guidelines / thumb rules in design and development of virtual product.  
 ME414.CO.4: Select the appropriate life cycle environmental strategies and project management schedule.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction to Product Lifecycle Management (PLM)</b>	<b>8 HOURS</b>
Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications Developing PLM Vision and PLM Strategy, Change management for PLM.		
<b>UNIT 2</b>	<b>Product Design</b>	<b>8 HOURS</b>
Product Design and Development Process, Engineering Design, Typologies of Design Process Models, PD Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, The Design for X System, Objective Properties and Design for X Tools.		
<b>UNIT 3</b>	<b>Product Data Management (PDM)</b>	<b>6 HOURS</b>
Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation.		
<b>UNIT 4</b>	<b>Virtual Product Development Tools</b>	<b>6 HOURS</b>
For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies.		
<b>UNIT 5</b>	<b>Integration of Environmental Aspects in Product Design</b>	<b>6 HOURS</b>
From Sustainable Development to Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process.		
<b>UNIT 6</b>	<b>Life Cycle Assessment and Life Cycle Cost Analysis</b>	<b>6 HOURS</b>
Introduction to Schedule Management, Configuring Schedule, Creating and managing schedules, Performing and tracking your tasks, Reviewing schedules and tasks, Costing of the project, Resource allocation.		


### **TEXT BOOK**

1. Grieves, Michael, Product Lifecycle Management, McGraw-Hill, 2006. ISBN 0071452303
2. Antti Sääksvuori, Anselmi Immonen, Product Life Cycle Management - Springer, 1st Edition Nov.5, 2003, ISBN 978-3-540-78172-1.
3. Stark, John. Product Lifecycle Management: Paradigm for 21st Century Product Realization, Springer Verlag, 2004. ISBN 1852338105
4. Kari Ulrich and Steven D. Eppinger, Product Design & Development, McGraw Hill International Edns, 1999, ISBN-13: 978-9352601851.

## REFERENCE BOOK

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1. John Stark, Product Lifecycle Management: Paradigm for 21st Century Product Realisation, Springer-Verlag, 2004. ISBN: 1852338105
2. Fabio Giudice, Guido La Rosa, Antonino Risitano, Product Design for the environment-A life cycle approach, Taylor & Francis 2006, ISBN: 0849327229
3. Saaksvuori Antti, Immonen Anselmie, Product Life Cycle Management, Springer, Dreamtech, ISBN: 3540257314
4. Michael Grieve, Product Lifecycle Management: Driving the next generation of lean thinking, Tata McGraw Hill, 2006, ISBN: 0070636265

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Computational Fluid Dynamics
		<b>COURSE CODE</b>	ME421
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	25	25	150

**PRE-REQUISITE :** Heat Transfer, Finite Element Analysis

**COURSE OBJECTIVES :**

ME421.CEO.1: Model fluid / heat transfer problems and apply fundamental conservation principles.  
 ME421.CEO.2: Discretize the governing equations by Finite Difference Method and Finite volume Method.  
 ME421.CEO.3: Develop software skills for conduction, convection and fluid dynamics problems.  
 ME421.CEO.4: Solve basic convection and diffusion equations and understands the role in fluid flow and heat transfer.

**COURSE OUTCOMES :**

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

ME421.CO.1: Explain and calculate the governing equations for fluid flow;  
 ME421.CO.2: Apply finite difference and finite volume methods to fluid flow problems  
 ME421.CO.3: Analyze and model fluid flow and heat transfer problems  
 ME421.CO.4: Generate high quality grids and interpret the correctness of numerical results with physics.  
 ME421.CO.5: Use a CFD tool effectively for practical problems and research.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Basic concepts of CFD</b>	<b>6 HOURS</b>
Review of FM and HT, Concept of substantial derivative, divergence and curl of velocity, Definition and overview of CFD, need, Advantages of CFD, Numerical vs Analytical vs Experimental, Applications of CFD, CFD methodology, grid independence, Verification and validation		
<b>UNIT 2</b>	<b>Governing Equations: Mass, Momentum &amp; Energy</b>	<b>8 HOURS</b>
Reynold's Transport Theorem, Navier Stokes equation, Derivation and physical interpretation of governing equations (conservation of mass, momentum and energy) in differential form, Mathematical behavior of partial differential equations – Elliptical, parabolic and Hyperbolic, Boundary conditions – Dirichlet, Neuman, Robbins, Initial Conditions.		
<b>UNIT 3</b>	<b>Discretization methods &amp; solution to conduction equation</b>	<b>6 HOURS</b>
Introduction to FEA, FDM and FVM, Solution of two dimensional steady and unsteady heat conduction equation using finite volume method (Implicit and Explicit), Stability Criteria.		
<b>UNIT 4</b>	<b>Solution to advection equation</b>	<b>8 HOURS</b>
Solution of two dimensional steady and unsteady heat advection equation using finite volume method (Implicit and Explicit) with Dirichlet BC, Stability Criteria, Introduction to first order upwind, CD, second order upwind and QUICK convection schemes.		
<b>UNIT 5</b>	<b>Solution to Convection-Diffusion Equation</b>	<b>6 HOURS</b>
Solution of two dimensional steady and unsteady heat convection-diffusion equation for slug flow using finite volume method (Implicit and Explicit), Stability Criteria, 1-D transient convection-diffusion system, Peclet Number		
<b>UNIT 6</b>	<b>Calculation of The Flow Field</b>	<b>6 HOURS</b>
Representation of the pressure gradient term, staggered grids, Pressure and Velocity Correction, SIMPLE Algorithm, SIMPLER Algorithm, PISO Algorithm		

<b>PRACTICAL: Perform the following experiments.</b>		
<b>PRACTICAL NO.01</b>	<b>Laminar flow through the pipe</b>	<b>4 HOURS</b>
Laminar flow through the pipe.		
<b>PRACTICAL NO.02</b>	<b>Temperature distribution in a pipe flow</b>	<b>4 HOURS</b>
Temperature distribution in a pipe flow.		
<b>PRACTICAL NO.03</b>	<b>Steady state temperature distribution in a rectangular plate</b>	<b>4 HOURS</b>
Steady state temperature distribution in a rectangular plate		
<b>PRACTICAL NO.04</b>	<b>Unsteady state temperature distribution in a rectangular plate</b>	<b>4 HOURS</b>
Unsteady state temperature distribution in a rectangular plate		
<b>PRACTICAL NO.05</b>	<b>Pin Fin</b>	<b>4 HOURS</b>
Temperature distribution over Pin Fin.		
<b>PRACTICAL NO.06</b>	<b>Natural convection</b>	<b>4 HOURS</b>
Natural Convection over Cylinder.		
<b>PRACTICAL NO.07</b>	<b>CFD Analysis of external flow</b>	<b>4 HOURS</b>
Circular Cylinder or Airfoil (NACA 0012).		


<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. John D Anderson: Computational Fluid Dynamics- The Basics with Applications, McGraw-Hill, ISBN:9780070016859.</li> <li>2. Atul Sharma, Introduction to Computational Fluid Dynamics: Development, Application and Analysis, Wiley, ISBN:9781119369189.</li> <li>3. Suhas V. Patankar, Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation, ISBN:9780891165224.</li> <li>4. A. W. Date, Introduction to Computational Fluid Dynamics, Cambridge Univ. Press, USA, ISBN:0521853265.</li> <li>5. H. Versteeg, and W.Malalasekara, An Introduction to Computational Fluid Dynamics: The Finite Volume Method, Pearson, ISBN:9780131274983.</li> </ol>

## REFERENCE BOOK

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1. H. Tennekes and J. L. Lumley, A First Course in Turbulence, MIT Press, ISBN:9780262200196.
2. David C. Wilcox, Turbulence Modeling for CFD, DCW Industries, ISBN:97811928729082.
3. H. Schlichting and K. Gersten, Boundary-Layer Theory, Springer, ISBN:9783662529195.
4. T. J. Chung, Computational Fluid Dynamics, Cambridge University Press, ISBN:9780521769693.
5. J. Tu, G.-H. Yeoh and C. Liu: Computational Fluid Dynamics: A practical approach, Elsevier, ISBN:9780080982534.



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	<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>		Robotic Vision
		<b>COURSE CODE</b>		ME422
		<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/06/2019</b>		<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
3	2	30	40	30	-	50	150

**PRE-REQUISITE :** Fundamentals of Robotics and Design , Kinematics and Dynamics of Robotics

**COURSE OBJECTIVES :**

ME422.CEO.1: Introduce the principles and applications of vision system in modern manufacturing.  
 ME422.CEO.2: Classify and prioritize various vision algorithms.  
 ME422.CEO.3: Organize different object recognition method.  
 ME422.CEO.4: Explore MATLAB/Python for image processing application.

**COURSE OUTCOMES :**

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

ME422.CO.1: Choose optimum parameters for robotics vision system.  
 ME422.CO.2: Apply image processing algorithms in robotics application.  
 ME422.CO.3: Illustrate various image capturing and processing techniques.  
 ME422.CO.4: Experiment with object recognition strategies.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Vision system</b>	<b>8 HOURS</b>
Basic Components – Elements of visual perception, Lenses: Pinhole cameras, Camera geometry and color sensing, sensors in robotics		
<b>UNIT 2</b>	<b>Low Level Vision</b>	<b>10 HOURS</b>
Introduction, Image acquisition, illumination techniques, imaging geometry, some basic relationship between pixels, preprocessing		
<b>UNIT 3</b>	<b>High Level Vision</b>	<b>8 HOURS</b>
Introduction, segmentation, description, segmentation and description of 3D structures, recognition, interpretation <b>Further Reading:</b>		
<b>UNIT 4</b>	<b>Object recognition and feature extraction</b>	<b>8 HOURS</b>
Object recognition, System component, Complexity of the object recognition, Object representation, Feature detection, recognition strategies, verification		
<b>UNIT 5</b>	<b>Applications of robotics vision</b>	<b>8 HOURS</b>
Pick and place robot, pedestrian detection, face detection, Introduction to ADAS		

<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>		<b>8 HOURS</b>
Hardware interfacing for image/video acquisition. Interfacing variety of hardware for image processing application		
<b>PRACTICAL NO.02</b>		<b>8 HOURS</b>
Image/Video processing techniques with OpenCV-Python/LABVIEW/MATLAB, Introduction to OpenCV-Python, Using modules for performing operations like image enhancement, filtering, thresholding, segmentation, edge detection etc.		
<b>PRACTICAL NO.03</b>		<b>8 HOURS</b>
Object detection with OpenCV-Python/LABVIEW/MATLAB, Development of algorithms for object detection in video/Camera streaming		

**TEXT BOOK**


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1. Saeed B Niku, "Introduction to robotics : analysis, Systems, applications", 2nd Ed New Delhi, Prentice Hall of India, 2009. 978-81-203-2379-7 Paperback
2. Richard D. Klafter, "Robotics Engineering: An integrated approach" ,Prentice-Hall (4 April 1989), 978-0134687520
3. Fu K S; Gonzalez R C; Lee C S G, "Robotics: Controls, Sensing, Vision and Intelligence" 00710990107 , McGraw-Hill Education, 978-0071004213

**REFERENCE BOOK**

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1. Rafael C. Gonzalez and Richard E. Woods. Digital Image Processing, Wesley, 2007. ISBN 13: 978813726952.
2. Prof. S. K. Saha. Introduction to robotics, Tata-McGraw-Hill, ISBN -13 – 9780070140011.

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Operations Management
		<b>COURSE CODE</b>	ME423
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	25	25	150

**PRE-REQUISITE :** Work Process Assessment

**COURSE OBJECTIVES :**

ME423.CEO.1: To study types of production.  
 ME423.CEO.2: To discuss components of balance sheet.  
 ME423.CEO.3: To apply appropriate planning and scheduling techniques based on product.  
 ME423.CEO.4: To solve demand forecasting problems using appropriate tools and techniques.  
 ME423.CEO.5: To prepare master production schedule for given product based on available man and machine resource.

**COURSE OUTCOMES :**

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

ME423.CO.1: Identify appropriate production system based on the product attributes such as variety, volumes etc.  
 ME423.CO.2: Explain the need of various functions in production planning for better management of manufacturing or service system.  
 ME423.CO.3: Prepare demand forecast model for given product or service.  
 ME423.CO.4: Analyze the material requirements for manufacturing environments.  
 ME423.CO.5: Develop aggregate plans, master production schedule, capacity requirement plans and material requirement plans as a part of resource requirements planning system.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Scope of Operations Management</b>	<b>6 HOURS</b>
Scope of Operations Management - Nature, Scope, Importance. Various Functions in Operations. Types of Production Systems – Project type, Job shop, Batch Production, Flow / Continuous Production, Mass Production - Characteristics and applicability of each type. Operations Strategies: Process choice – Select the appropriate production system, Competitiveness with Operations, Competing on cost, quality, flexibility, speed, reliability. Order Winners & Order Qualifiers. Introduction to ETO, MTO, ATO & MTS. Functions in Operations Management. Relations of operations with R&D, Design, Materials, Marketing, Finance, Personnel.		
<b>UNIT 2</b>	<b>OPC and Material Requirement Planning I (MRP I)</b>	<b>8 HOURS</b>
Operations Planning & Control – PPC – Functions, Operations Planning & Control Framework. Material Requirement Planning (MRP I): Inputs to MRP – MPS, BOM – Types of BOM, BOM Explosion, Inventory Transaction Files, MRP Processing (Logic) – Time Phased Operation Plan, Numerical on BOM Explosion Netting Requirements, Outputs of MRP. Significance of Process Planning. Preparation of Process, Plans & Process Sheets, Time, Cost & Material Estimation.		
<b>UNIT 3</b>	<b>Material Requirement Planning II (MRP II)</b>	<b>6 HOURS</b>
MRP II (Manufacturing Resource Planning) Operations Control – Gantt Charts. Planning & Scheduling Techniques: Scheduling v/s Loading, Scheduling Types – Forward Scheduling & Backward Scheduling Techniques – Dispatching Rules – SPT, LPT, Critical Ratio, EDD, etc. Evaluate lateness, tardiness. Documentation - Production Work Order. Techniques of scheduling, dispatching and expediting. Nature of production control in different types of production systems.		
<b>UNIT 4</b>	<b>Demand Forecasting</b>	<b>8 HOURS</b>
Components of Demand, Techniques of Demand Forecasting – Qualitative (Survey & Judgmental – Delphi, Expert Opinion) & Quantitative (Causal Methods – Input-Output Method, Leading Indicators Method & Time Series Analysis– Moving Average, Exponential Smoothing, Regression Method). Holts Model, Winters Model, Box-Jenkins Model. Measuring Errors in Forecasting – MAD, MSE, Tracking Signal Qualitative Techniques of Forecasting – Experts Opinion, Delphi Method, Market Survey		
<b>UNIT 5</b>	<b>Aggregate Planning &amp; Quantitative Techniques in Scheduling</b>	<b>6 HOURS</b>
Pure Strategies – Chase, Level, Mixed Strategies, Master Production Schedule, Detailed Capacity Requirement Planning, Johnsons Algorithm - Sequencing n jobs on m machines, Assignment Models. Numerical & Cases in Aggregate Planning.		
<b>UNIT 6</b>	<b>Engineering Economy – Scope of Finance</b>	<b>6 HOURS</b>
Statements of Financial Information: Introduction, Source of financial information, Financial statements, Balance sheet, Profit and Loss account, relation between Balance sheet and Profit and Loss account. Simple Numerical Examples		

<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>	<b>Production System</b>	<b>2 HOURS</b>
Assignment on Production Systems		
<b>PRACTICAL NO.02</b>	<b>Operations strategy</b>	<b>2 HOURS</b>
Case on Operations Strategy & Process Choice		
<b>PRACTICAL NO.03</b>	<b>Material requirement planning</b>	<b>4 HOURS</b>
Assignment on MRP 1 – BOM Explosion or Netting requirements		
<b>PRACTICAL NO.04</b>	<b>Demand Forecasting</b>	<b>4 HOURS</b>
Assignment on demand forecasting – Quantitative Model or Qualitative techniques		
<b>PRACTICAL NO.05</b>	<b>Capacity planning</b>	<b>2 HOURS</b>
Assignment on capacity planning		
<b>PRACTICAL NO.06</b>	<b>Aggregate planning</b>	<b>2 HOURS</b>
Assignment on aggregate planning		
<b>PRACTICAL NO.07</b>	<b>Job shop scheduling</b>	<b>2 HOURS</b>
Assignment on job shop scheduling		
<b>PRACTICAL NO.08</b>	<b>Johnson’s rule</b>	<b>4 HOURS</b>
Assignment on Johnson’s rule		
<b>PRACTICAL NO.09</b>	<b>Balance sheet</b>	<b>2 HOURS</b>
Case study of balance sheet		
<b>PRACTICAL NO.10</b>	<b>Profit and loss account</b>	<b>4 HOURS</b>
Case study of balance sheet with respect to profit and loss account		


### **TEXT BOOK**

1. Chase, Aquilano, Jacobs, Operations Management for Competitive Advantage, Tata McGraw Hill, ASIN: B07VM96K54
2. Chary, Production & Operations Management –McGraw Hill Publications S K Mukhopahyay, Operations Planning & Control, Jaico Publications
3. S K Mukhopahyay, Operations Planning & Control, Jaico Publications
4. Engineering Economy - Paul Degarmo, Macmillan Pub, Co. 2001, ISBN-00-23286008.

## **REFERENCE BOOK**

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1. Krajewski, Operations Management, 9th Edition, Pearson Education, ISBN-13: 978-0136065760.
2. Production & Operations Management – Panneerselvam, McGraw Hill Publications, ASIN: B00K7YK5X6.
3. Financial Mangement, Prasanna Chandra, TMH, 2004, ISBN-13: 978-9353166526.

 <b>Academy of Engineering</b> (An Autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FOURTH YEAR BACHELOR OF TECHNOLOGY</b>		<b>COURSE NAME</b>	Sociology
		<b>COURSE CODE</b>	HP402
		<b>COURSE CREDITS</b>	2
<b>RELEASED DATE : 01/06/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
1	NIL	NIL	50	20	NIL	NIL	70

**PRE-REQUISITE : NIL**

**COURSE OBJECTIVES :**

HP402.CEO.1: The course focuses on the society in India with an attempt to acquaint students with sociology as a social science and the distinctiveness as a social science.

HP402.CEO.2: It displays the relevance and significance of sociology in understanding the society and in attempting to solve its problems.

HP402.CEO.3: Many of the Sociological Changes are an answer to the age-old social norms and practices giving rise to a solution which is critical to social issues and problems.

HP402.CEO.4: The course sensitizes students to the emerging social issues and enables them to acquire sociological understanding of these issues with an ability to answer the problems.

HP402.CEO.5: Projects in Sociology are tools that facilitate the construction of knowledge in imparting the right attitude towards social issues .

**COURSE OUTCOMES :**

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

HP402.CO.1: Get acquainted to sociology as a social science.

HP402.CO.2: Explain the significance of sociology in solving problems.


HP402.CO.3: Derive solutions to critical social issues.

HP402.CO.4: Change their attitude towards social issues.



<b>THEORY</b>		
<b>UNIT 1</b>	<b>Introduction to Sociology</b>	<b>6 HOURS</b>
The nature of Sociology, meaning of Sociology: Origin, Definition, Scope, Culture, meaning, components, beliefs, values, norms, technology, diversity, towards a global culture.		
<b>UNIT 2</b>	<b>Sociolization</b>	<b>5 HOURS</b>
Socialization, Agents of Socialization, Heredity and Environment, Group, Social structure, Status and role, family, school, peer group, media, adult socialization, resocialization, Role of Social moments, Illustrations: Women, Tribal & Dalit Movements . <b>Further Reading:</b>		
<b>UNIT 3</b>	<b>Nature and factors of Social Change</b>	<b>5 HOURS</b>
Change: Meaning. Nature and factors of Social Change: Biological Factors. Demographic Factors, Technological Factors, Economic Factors Cultural Factors, Info-tech factors, Meaning of Gender sensitization, Discrimination, violence and Abuse. <b>Further Reading:</b>		
<b>UNIT 4</b>	<b>Visions of Social Change in India</b>	<b>4 HOURS</b>
Idea of development planning and mixed economy, Constitution, law and social change, Education and social change. <b>Further Reading:</b>		
<b>UNIT 5</b>	<b>Works and Economic Life</b>	<b>4 HOURS</b>
Social organization of work in different types of society- slave society, feudal society, industrial /capitalist society. Formal and informal organization of work. Labour and society. <b>Further Reading:</b>		
<b>UNIT 6</b>	<b>Introduction to Applied sociology</b>	<b>4 HOURS</b>
The use of Sociology: Introduction to applied Sociology-Sociology and social problems, Ecology and Environment: Pollution, Global warming and Greenhouse effect. Impact of Industrialization and Urbanization on Environment.		

<b>REFERENCE BOOKS</b>
1. T.B. Bottomore, Sociology: A Guide to Problems and Literature, Blackie and Sons Publishers, 1978, ISBN:978-0043000267
2. Sociology: A guide to problems and literature. Bombay: George Allen and Unwin (India): Harlambos, M.1998. ISBN: 978-0043000267
3. Sociology: Themes and perspectives. New Delhi Oxford University Press.: Inkeles, Alex, 1987
4. What is Sociology, Madras: Macmillan, India: Johnson, Harry M. 1995.
5. Sociology: A Systematic Introduction. New Delhi, Allied Publishers. ISBN: 978-8170231370 .

 <b>MIT</b> (An Autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>			<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>			<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FOURTH YEAR BACHELOR OF TECHNOLOGY</b>			<b>COURSE NAME</b>		Bussiness Strategies
			<b>COURSE CODE</b>		HP403
			<b>COURSE CREDITS</b>		1
<b>RELEASED DATE : 01/06/2019</b>			<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>CA</b>			
-	2	NIL	NIL	25	NIL	25	50

**PRE-REQUISITE :** HP303 : Basics of Entrepreneurship

**COURSE OBJECTIVES :**

HP403.CEO.1: To understand the importance of growth and to be able to chart a path towards growth.  
 HP403.CEO.2: To revisit your business model  
 HP403.CEO.3: To give a growth orientation your customer acquisition, operations, revenue and sales strategy  
 HP403.CEO.4: To list and comply with the requirements relating to regulatory compliance  
 HP403.CEO.5: To be able to effectively pitch your venture to potential stakeholders .

**COURSE OUTCOMES :**

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


HP403.CO.1: Rephrase business model and Identify additional customer segments  
 HP403.CO.2: Identify channels and strategy for budgeting and planning.  
 HP403.CO.3: Make use of Legal aspect, Mentors, Advisors, and Experts in startups  
 HP403.CO.4: Analyze the growing revenues, sales planning, strengthening sales, improving margins  
 HP403.CO.5: Estimate customer lifetime value, competitor and peer’s financial models for venture growth  
 HP403.CO.6: Formulate the all procedure for new venture ; Product market fit and A Pitch Deck

<b>PRACTICALS:</b>		
<b>PRACTICAL NO.01</b>	<b>Orientation to Growth</b>	<b>3 HOURS</b>
<b>Getting Ready for Growth</b> Why growth stage is different compared to startup phase, Why Product-Market fit is not enough, Case study, To assess readiness for growth, To chart a growth path .		
<b>PRACTICAL NO.02</b>	<b>Customers</b>	<b>3 HOURS</b>
<b>Expanding Customer Base</b> Revisit your business model and develop few variants (more business model types). Identify additional customer segments that your solution can address. Evaluate business models for the new customer segments. Relook at the Problem Statement (can you expand the scope and scalability of your business by repositioning your problem statement?) Explore additional ways to monetize.		
<b>PRACTICAL NO.03</b>	<b>Traction</b>	<b>12 HOURS</b>
<b>Scaling</b> How to gain traction beyond early customers. Defining traction (in quantifiable terms) and identifying the most important metrics to measure traction. Calculate cost of new customer acquisition. Estimate your customer lifetime value (LTV). Identifying waste in your operations and focusing your team on what is important for traction. <b>Channels and Strategies</b> The Bulls eye framework, Identify Channels using Bulls Eye Framework, Measuring the effectiveness of selected channels, Budgeting and planning.		
<b>PRACTICAL NO.04</b>	<b>Money</b>	<b>20 HOURS</b>
Growing Revenues. Stabilizing key revenue streams. Developing additional revenue streams (licensing, franchising). Exploring new channels and partnerships. Sales Planning. Understanding why customers buy and how buying decisions are made; Listening skills. Sales planning, setting targets. Unique Sales Proposition (USP); Art of the sales pitch (focus on customer’s needs, not on product features) Follow-up and closing a sale; Asking for the sale. Strengthening Sales. Building a professional sales team. Sales compensation and incentives. Sales planning, setting targets Improving Margins. Testing price elasticity. Optimizing costs and operational expenses. Advanced concepts of unit costing. Financial Modeling. Financial modeling of your venture’s growth. Analyzing competitor and peer’s financial models.		
<b>PRACTICAL NO.05</b>	<b>Support</b>	<b>5 HOURS</b>
Legal Overview of legal issues and their impact on entrepreneurs. Importance of getting professional help (legal and accounting). Importance of being compliant and keeping proper documentation. Patents and Intellectual property. Trademarks. Mentors, Advisors, and Experts. The importance of a Mentor and how to find one. Role of business advisors and experts for specific targets in your growth plan.		
<b>PRACTICAL NO.06</b>	<b>Capstone Project: Pitch Your Venture</b>	<b>2 HOURS</b>

## REFERENCE BOOKS

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1. Zero to One: Note on Start Ups, or How to Build the Future, Peter Thiel and Blake Masters, Virgin Books,ISBN: 9780753555194
2. Tools of Titans: The Tactics, Routines, and Habits of Billionaires, Icons, and World-Class Performers, Timothy Ferriss, Random House,ISBN: 9781785041273.
3. Disrupted: My Misadventure in the Start-Up Bubble, Dan Lyons, Penguin Publishers, ISBN: 9781786491022
4. Unshakeable: Your Financial Freedom Playbook, Tony Robbins, Simon & Schuster Publishers,ISBN: 9781471164934
5. Grit: The Power of Passion and Perseverance, Angela Duckworth, Vermilion Publishing,ISBN: 9781785040207
6. Big Magic: Creative Living 4BEyond Fear, Elizabeth Gillbert, Penguin Publishers,ISBN: 9781408886182
7. Pivot: The Only Move That Matters Is Your Next One, Jernny Blake, Random House,ISBN: 9780241975466
8. Financial Management; Text and Problems, 7th Ed., A Khan and P. K. Jain, TataMacGraw Hill, ISBN: 9789353162184
9. Financial Management; Theory and Practice, 4th Ed., Prasanna Chandra, TataMacGraw Hill, ISBN: 9789339222574
10. Essentials of Management : An International and Leadership Perspective, 10th Ed., Harold Koontz and Heinz Weihrich, MGH, ISBN: 9789339222864
11. Kites in a Hurricane: Startups from Cradle to Fame, Rishi Kapal, SAGE Publishing, ISBN: 9789352807895
12. Wadhvani Foundation “Advanced Course in Entrepreneurship”

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Piping Design
		<b>COURSE CODE</b>	ME403
		<b>COURSE CREDITS</b>	1
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
-	2	-	-		50	-	50

**PRE-REQUISITE :** Machine Design, Thermal Engineering

**COURSE OBJECTIVES :**

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ME403.CEO.1: To introduce the design of piping system.  
 ME403.CEO.2: Apply knowledge of piping design software for Mechanical & Chemical Engineering applications

**COURSE OUTCOMES :**


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

ME403.CO.1: Create piping layout in piping design software package.  
 ME403.CO.2: Design piping system for Mechanical & Chemical Engineering Applications

<b>PRACTICAL: To be conducted on Piping Design Software Package</b>		
<b>PRACTICAL NO.01</b>		<b>2 HOURS</b>
ASME B31 Piping Codes, Basic understanding of AutoCAD Plant 3D,		
<b>PRACTICAL NO.02</b>		<b>2 HOURS</b>
Setting up the Plant 3D workspace, Working with Plant 3D files		
<b>PRACTICAL NO.03</b>		<b>2 HOURS</b>
Creating a new model		
<b>PRACTICAL NO.04</b>		<b>6 HOURS</b>
Working with the structural Objects, Creating equipment		
<b>PRACTICAL NO.05</b>		<b>6 HOURS</b>
Basic pipe routing, Moving and copying data		
<b>PRACTICAL NO.06</b>		<b>4 HOURS</b>
Isometric drawings		
<b>PRACTICAL NO.07</b>		<b>2 HOURS</b>
Project Work		
<b>PRACTICAL NO.08</b>	<b>Mini Project</b>	<b>4 HOURS</b>
Students should take a problem of their choice and verify the CFD solution with experimental data / research paper.		

<b>REFERENCES</b>	
<ol style="list-style-type: none"> <li>1. Help of Piping Design Software Smart® 3D – developed by INTERGRAPH CORPORATION</li> <li>2. PDMS – Plant design &amp; Management software developed by AVEVA PLANT</li> <li>3. PDS- Plant design software developed by INTERGRAPH CORPORATION</li> <li>4. AutoPLANT developed by BENTLEY</li> <li>5. CADWorx developed by INTERGRAPH CORPORATION</li> <li>6. AutoCAD plant-3D by Autodesk</li> </ol>	

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Six Sigma
		<b>COURSE CODE</b>	ME404
		<b>COURSE CREDITS</b>	1
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
-	2	-	-	25	25	-	50

**PRE-REQUISITE :** Quality Assurance

**COURSE OBJECTIVES :**

ME404.CEO.1: To recall the fundamentals of Quality Control tools.  
 ME404.CEO.2: To apply various optimization tools to solve industrial problems.  
 ME404.CEO.3: To suggest suitable quality control tool for QMS.

**COURSE OUTCOMES :**


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

ME404.CO.1: Demonstrate the productivity improvement aspects in their field.  
 ME404.CO.2: Accumulate, organize the data and analyze for identifying the problem and getting the solution to the problem.  
 ME404.CO.3: Excel the knowledge using applied tools in Six Sigma and Lean.  
 ME404.CO.4: Streamline the work procedures.  
 ME404.CO.5: Orient on Minitab Software

<b>PRACTICAL: To be conducted on Piping Design Software Package</b>		
<b>PRACTICAL NO.01</b>		<b>4 HOURS</b>
Prepare Project charter for an improvement project - including DMAIC plan		
<b>PRACTICAL NO.02</b>		<b>4 HOURS</b>
Team Role and responsibilities- Role Play		
<b>PRACTICAL NO.03</b>		<b>6 HOURS</b>
Use of Minitab software for advanced Data analysis- Inferential statistical tests- Z, t, Chi square, ANOVA		
<b>PRACTICAL NO.04</b>		<b>4 HOURS</b>
Improvement project for- Manufacturing/Service/ IT industry		
<b>PRACTICAL NO.05</b>		<b>4 HOURS</b>
Implementation aspects & Presentation of Six Sigma in organization's		
<b>PRACTICAL NO.06</b>		<b>4 HOURS</b>
Solving Lean management case lets		
<b>PRACTICAL NO.07</b>		<b>2 HOURS</b>
Project Work		

<b>REFERENCES</b>
<ol style="list-style-type: none"> <li>1. Six Sigma handbook,by Thomas Pyzdek, Paul Keller, McGraw-Hill Education; 4 edition, ISBN-13: 978-0071840538</li> <li>2. Implementing Six Sigma and Lean: A practical guide to tools and techniques,Ron Basu, Butterworth-Heinemann; 1 edition, ISBN-13: 978-1856175203</li> <li>3. Six Sigma for Business Excellence: Approach, Tools and Applications 1st Edition, Kindle Edition, ASIN: B00AQTN08E</li> </ol>



 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>		<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>		Energy Audit
		<b>COURSE CODE</b>		ME405
		<b>COURSE CREDITS</b>		1
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
-	2	-	-	25	25	-	50

**PRE-REQUISITE :** Power Plant Engineering

**COURSE OBJECTIVES :**

ME405.CEO.1: To understand the importance of energy conservation and energy audit.  
 ME405.CEO.2: To learn essential steps of energy audit.  
 ME405.CEO.3: To understand performance evaluation of various thermal and electrical energy systems.  
 ME405.CEO.4: Analyze technical and financial feasibility of energy conservation projects.

**COURSE OUTCOMES :**


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

ME404.CO.1: Compare energy scenario and energy security aspects of India and World.  
 ME404.CO.2: Apply energy audit methodology in industry.  
 ME404.CO.3: Apply financial techniques to check feasibility of energy conservation projects.  
 ME404.CO.4: Evaluate performance of thermal utilities and relevant energy conservation opportunities.  
 ME404.CO.5: Evaluate performance of electrical utilities and relevant energy conservation opportunities.

<b>PRACTICAL</b>		
<b>PRACTICAL NO.01</b>	<b>General Aspects of Energy Management</b>	<b>4 HOURS</b>
Types of energy, Present energy scenario - India and World, Relationship between Environment and Energy, Concept of Energy Conservation and Energy Efficiency (EE), Energy Conservation Act – 2001 and its features – ECBC, S&L, DSM, BLY, DC, Certification of Energy Managers and Energy Auditors.		
<b>PRACTICAL NO.02</b>	<b>Principles of Energy Audit</b>	<b>4 HOURS</b>
Energy Audit – definition and need, Types of energy audit, Energy Audit Methodology, Instruments used for Energy Audit Understanding energy costs, bench marking, energy performance, Fuel and energy substitution, Analysis and recommendations of energy audit, Energy Audit reporting.		
<b>PRACTICAL NO.03</b>	<b>Energy Efficiency in Thermal Utilities</b>	<b>8 HOURS</b>
Numerical treatment - Energy performance assessment of Boilers (Direct and indirect method), Furnaces (Direct and indirect method), Insulation, Waste Heat Recovery, Cooling towers, HVAC systems, energy conservation opportunities in thermal utilities.		
<b>PRACTICAL NO.04</b>	<b>Energy Efficiency in Electrical Utilities</b>	<b>8 HOURS</b>
Introduction to electrical power supply system, Electricity billing, Electrical load management, Step by step approach for MD Control, Power factor improvement and benefits, Selection and location of capacitors (Numerical treatment). Electrical motors - working, types, Characteristics, Loading, efficiency, selection, Energy efficient motors, Speed control (Conceptual Numerical treatment) Performance evaluation of compressors, Lamp types and their features, recommended illumination levels, Lighting system performance assessment and efficiency improvement (Numerical). Energy conservation opportunities in thermal utilities.		
<b>PRACTICAL NO.05</b>	<b>Financial Analysis</b>	<b>4 HOURS</b>
Costing of utilities – steam, compressed air, financial analysis methods – Simple Payback Period (SPP), Time Value of Money, Net Present Value (NPV), Return on Investment (ROI), Internal Rate of Return (IRR) (Simple numerical treatment)		

## **REFERENCES**

1. Handbook of Energy Audit, Albert Thumann, P.E. CEM, William J. Younger CEM, The Fairmont Press Inc., 7th Edition, ISBN 0-88173-685-6
2. Handbook on Energy Audit and Environment management, Y. A. Abbi, S. Jain, TERI, Press, New Delhi, 2006, ISBN 81-7993-092-0
3. Energy Management Handbook, Wayne C. Turner, The Fairmont Press Inc., 5th Edition, Georgia, ISBN: 0-88173-542-6
4. Guide books of BEE For Examination on Certification of Energy Managers and Energy Auditors.

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>	<b>COURSE SYLLABI (2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Major Project - I
		<b>COURSE CODE</b>	ME402
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
-	8	-	-	-	100	50	150

**PRE-REQUISITE:** Minor Project, Mini Project

**COURSE OBJECTIVES :**

ME402.CEO.1: To implement the idea/ real time industrial problem/ current application from engineering domain

ME402.CEO.2: To evaluate an alternative approaches and justify the use of selected tools and methods

ME402.CEO.3: To inculcate skills in engineering product design and development process, budgeting, Planning, testing, effective trouble-shooting practices.

ME402.CEO.4: To understand the roles and responsibility, accountability and learn team work ethics

**COURSE OUTCOMES :**

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

ME402.CO1: Solve real life problems by applying the knowledge and problem solving ability.

ME402.CO2: Analyze alternative approaches, find feasible solution and apply most appropriate one.

ME402.CO3: Use standard engineering tools and processes for analysis, design, simulation, testing, Implementation and deployment of idea into practice.

ME402.CO4: Participate effectively in multidisciplinary and heterogeneous teams exhibiting team work, inter-personal Relationship, conflict management and leadership quality.

#### PREAMBLE:

objective of this Major Project-I course is to understand the Product Development through team work. The students will be able to shoulder the roles and responsibility and activity distribution amongst them. The students will learn designing, budgeting, planning, engineering skills and processes, testing and effective trouble-shooting practices, safety norms and standards while developing the application/product. The students will deliver a presentation on the advancement in Technology pertaining to the selected project topic and be able to understand importance of document design and professional ethics.

#### GUIDELINES:

Project work stage –I is an integral part of Project work. In this, the student shall complete the partial work of project, consist of problem statement, literature survey, Project specification and planning. The students expected to complete the project at least up to the design phase. As a part of project phase-I, candidate shall appear for two reviews and delivered the presentation on the advancement of selected project topic. The student shall submit the duly certified project report in standard format for satisfactory completion of work by the concern Advisor and Dean of the School.

The examinee will be assessed by panel of examiner of which one is necessarily as a external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question answer and report.

**Preparation of the Literature survey paper and communicating and publishing in relevant publishing agency is recommended. Bonus 10 marks will be awarded.**

**Follow the guideline and formats as mentioned in guideline document Annexure-I.)**

#### TIMELINE

1. Formation of Project Group: 2 Weeks (1st ,2nd week)
2. Presentation of Project Review -1- Finalizing title with feasibility study and approval: 2 Weeks (3rd, 4th week)
3. Presentation of Project Review -2 Analysis and Design of Project: 2 weeks (7th, 8th week)
4. Preparation of Project Progress Report – I (week 9th and 10th)
5. Project Phase-I Evaluation by external examiner ( End Semester by 12th, 13th week)


#### ASSESSMENT

##### 1. Internal Assessment (TW)

- a. Project Review -1 Project Approval -30 Marks
- b. Project Review -2 Analysis and Design- -30 Marks
- c. Project Review -3 Project progress Report-I and Presentation - 40 Marks
- d. Paper publication/IPR -10 marks (Bonus)

##### 2. Examination: Final Demonstration and presentation

- a. Project presentation: 15 Marks
- b. Project design / execution / demonstration : 20 Marks
- c. Project Report preparation and documentation: 15 Marks

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	<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>		Noise Vibration & Harshness
		<b>COURSE CODE</b>		ME431
		<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
3	2	30	40	30	25	25	150

**PRE-REQUISITE :** Machines & Mechanisms

**COURSE OBJECTIVES :**

ME431.CEO.1: To develop analytical competency in solving vibration problems.

ME431.CEO.2: To know and able to determine the natural frequency of the single-degree freedom system.

ME431.CEO.3: To know the fundamentals of acoustics and Indian standards of Noise.

ME431.CEO.4: To know the sound absorbing materials and its practical applications.

ME431.CEO.5: To know the measurement and control techniques of vibration and noise.

ME431.CEO.6: To understand the effect of noise on human comfort and environment.

**COURSE OUTCOMES :**

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

ME431.CO.1: Solve one, two-degree freedom system problems.

ME431.CO.2: Apply the knowledge of acoustics in practice.

ME431.CO.3: Implement the measurement and control techniques of Vibration and Noise.

ME431.CO.4: Analyse the sources, effects of noise & vibration.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Fundamentals of Vibration</b>	<b>10 HOURS</b>
<p>Single Degree of Freedom Systems – Free Vibration            Introduction, Definition, Types of vibration, Introduction to Physical and Mathematical modeling of vibratory systems: Bicycle, Motor bike and Quarter Car. Formulation of differential equation of motion (Newton, D'Alembert and energy method)            Undamped free vibrations: Natural frequency for longitudinal, transverse and torsional vibratory systems. Damped free vibrations: Different types of damping, Viscous damping – over damped, critically damped and under damped systems, initial conditions, and logarithmic decrement.            Single Degree of Freedom Systems - Forced Vibrations            Forced vibrations of longitudinal, Frequency Response to harmonic excitation, magnification factor, Force and Motion transmissibility, Quality Factor. Half power bandwidth method.</p>		
<b>UNIT 2</b>	<b>Two Degree of freedom systems</b>	<b>8 HOURS</b>
<p>Free vibration of spring coupled systems – longitudinal, natural frequency and mode shapes, Eigen value and Eigen vector by Matrix method, Undamped dynamic vibration absorber. Modal analysis of free and forced undamped and damped vibrations.</p>		
<b>UNIT 3</b>	<b>Fundamental of Noise</b>	<b>8 HOURS</b>
<p>Introduction to Sound, Sound propagation, wave equation, Quantification of sound- frequency and wavelength, Sound levels and decibels, sound power level sound pressure level, Sound intensity level, Octave &amp; 1/3 octave bands, A weighting, Sound field, Sound reflection ,absorption and transmission - concept &amp; governing equation with correlation of each other, Loudness, Introduction to harshness.</p>		
<b>UNIT 4</b>	<b>Noise Measurement and Control</b>	<b>8 HOURS</b>
<p>Noise measuring instruments- microphones, types of microphones Sound pressure measurement, Sound power measurement, Sound intensity measurement, Measurement of sound transmission loss, sound level meter, FFT spectrum analyzer, conditioning monitoring, Introduction to array techniques - Acoustic holography &amp; beam forming. Major Sources of noise, noise due to construction equipments and domestic applications, Interior Noise of Automobiles - Interior noise sources, Structure borne noise, airborne noise. Industrial noise, industrial noise control- strategies, noise control at the source, noise control at the path, Acoustic barriers, noise control at the receiver. Active noise control techniques.</p>		
<b>UNIT 5</b>	<b>Passive Noise Treatments</b>	<b>6 HOURS</b>
<p>Ducts &amp; Mufflers – Types of mufflers, performance parameters – acoustics and back pressure, reactive and absorptive silencers and overall design considerations. Acoustic Material Characterization – Sound transmission, absorption and damping, Behavior of acoustic material with respect to sound absorption and transmission, Standard methods for evaluating sound absorption coefficient and transmission loss, Types of sound absorbers, Prediction of transmission loss, Damping materials and their applications.</p>		
<b>UNIT 6</b>	<b>Noise Regulations</b>	<b>6 HOURS</b>
<p>Non-auditory and auditory effect noise on human beings, Noise standards and limits in India, Ambient emission noise standards in India, Hazardous noise exposure – legal aspects, Day night sound level, Noise specifications for automotive vehicles – pass-by &amp; stationary and Noise specifications for generator sets, firecrackers and household articles.</p>		

<b>PRACTICAL: Perform the following experiments</b>		
<b>PRACTICAL NO.01</b>		<b>2 HOURS</b>
To determine the natural frequency of damped vibration of single degree freedom system and to find it 's damping coefficient.		
<b>PRACTICAL NO.02</b>		<b>2 HOURS</b>
To obtain frequency response curves of single degree freedom system of vibration for different amount of damping.		
<b>PRACTICAL NO.03</b>		<b>2 HOURS</b>
Measurement of vibration parameters like frequency, amplitude, velocity and acceleration of any vibrating system by using vibration measuring instrument.		
<b>PRACTICAL NO.04</b>		<b>2 HOURS</b>
To determine natural Frequency of Transverse Vibration of Beam using vibration analyser.		
<b>PRACTICAL NO.05</b>		<b>2 HOURS</b>
Analysis of machine vibration signature using analysis software package.		
<b>PRACTICAL NO.06</b>		<b>2 HOURS</b>
Noise measurement and analysis using vibration analyser.		
<b>PRACTICAL NO.07</b>		<b>2 HOURS</b>
Determination of sound absorption coefficient of acoustic material by using impedance tube		
<b>PRACTICAL NO.08</b>		<b>2 HOURS</b>
Determination of transmission loss of reactive silencer by using impedance tube.		
<b>PRACTICAL NO.09</b>	<b>Projects 1</b>	<b>2 HOURS</b>
Simulation (using suitable software) of free response of SDOF damped system to demonstrate different damping conditions by solving differential equation numerically.		
<b>PRACTICAL NO.10</b>	<b>Project 2</b>	<b>2 HOURS</b>
Simulation (using suitable software) of total response of SDOF damped system to harmonic excitation by solving differential equation numerically.		

### **TEXT BOOK**

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1. Rao S. S., Mechanical Vibrations, Pearson Education Inc. New Delhi. ISBN 978-0-13-212819-3
2. Grover G. K., Mechanical Vibrations, New Chand and Bros., Roorkee ISBN-10: 9788185240565
3. Clarence W. de Silva, Vibration Monitoring, Testing, and Instrumentation, CRC Press, 2007 ISBN 9781420053197
4. David A. Bies and Colin H. Hansen Engineering Noise Control: Theory and Practice Spon Press, London, 2009 ISBN 0-203-16330-3
5. C. Sujatha Vibration and Acoustics : McGraw hill Publication 2010 ISBN 10: 0070148783
6. M. L. Munjal, Acoustics of Ducts and Mufflers, Willy publications, ISBN 9780471847380
7. A. G. Ambekar, Mechanical Vibration and Noise Engineering, PHI publications, ISBN. 9788120329003

### **REFERENCE BOOK**

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1. Bell, L. H. and Bell, D. H., Industrial Noise Control Fundamentals and Applications, Marcel Dekker Inc, ISBN 10: 0824790286
2. Meirovitch, Elements of Mechanical Vibrations, McGraw Hill ISBN-10: 0070413401
3. Ver, Noise and Vibration Control Engineering, Wiley India Pvt. Ltd, New Delhi ISBN: 9780471449423
4. Bies, D. and Hansen, C., Engineering Noise Control Theory and Practice, ISBN 9781498724050
5. Kelly S. G., Mechanical Vibrations, Schaum's outlines, Tata McGraw Hill Publishing Co. Ltd., New Delhi, ISBN 13: 9780070616790
6. Allan G. Piersol, Thomas L. Paez Harris' Shock and Vibration Handbook, McGraw-Hill, New Delhi, 2010, ISBN: 0071508198
7. William Thomas and Marie Dillon Dahleh-Theory of Vibration with Applications. Pearson Publishing, 2007, ISBN-10: 013651068



 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Hydraulics & Pneumatics
		<b>COURSE CODE</b>	ME441
		<b>COURSE CREDITS</b>	3
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	Nil	30	40	30	Nil	Nil	100

**PRE-REQUISITE :** Fluid Mechanics

**COURSE OBJECTIVES :**

ME441.CEO.1: Study Application of fluid mechanics and governing laws in hydraulic and pneumatic systems.

ME441.CEO.2: Study of working principle of various components used in hydraulic and pneumatic systems.

ME441.CEO.3: Selection of different components used in hydraulic and pneumatic systems.

ME441.CEO.4: Design of hydraulic and pneumatic circuits.

ME441.CEO.5: Understand Industrial applications of hydraulic and pneumatic circuits.

**COURSE OUTCOMES :**

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

ME441.CO.1: Find working principle of various components used for hydraulic & pneumatic systems.

ME441.CO.2: Identify various components of hydraulic & pneumatic systems.

ME441.CO.3: Select appropriate components required for hydraulic and pneumatic systems.

ME441.CO.4: Enlist industrial applications of hydraulic and pneumatic system.

ME441.CO.5: Troubleshooting of hydraulic & pneumatic circuits through Automation studio software.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Fluid Power Principles and Fundamentals</b>	<b>8 HOURS</b>
Introduction to Fluid power- Advantages and Applications- Fluid power systems, Types of fluids- Properties of fluids, Basics of Hydraulics -Pascal's Law- Principles of flow, Work, Power and Torque. The source of Hydraulic Power: Pumps - Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, pump Selection factors, troubleshooting of pumps.		
<b>UNIT 2</b>	<b>Control Components in Hydraulic Systems</b>	<b>8 HOURS</b>
Classification of control valves, Directional Control Valves- Symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, check valves, Pressure control valves - types, direct operated types and pilot operated types. Flow Control Valves -compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.		
<b>UNIT 3</b>	<b>Hydraulic Actuators and Motors</b>	<b>8 HOURS</b>
Classification of actuators: Cylinder and hydraulic motors, Linear Hydraulic Actuators-cylinders, single and double acting cylinder, Mechanics of Hydraulic Cylinder Loading, mounting arrangements, cushioning, special types of cylinders, problems on cylinders, construction and working of rotary actuators such as gear, vane, piston motors, Hydraulic Motor Theoretical Torque, Power and Flow Rate, problems, symbolic representation of hydraulic actuators cylinders and motors.		
<b>UNIT 4</b>	<b>Pneumatic Systems</b>	<b>8 HOURS</b>
Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Servo systems, General function of Industrial Automation, Safety in Industrial Automation, Practical Programmable Logic Controller Applications, Logical Program Development.		
<b>UNIT 5</b>	<b>Analysis of Hydraulic and Pneumatic Circuits</b>	<b>6 HOURS</b>
Analysis of various hydraulic circuits like safety circuits, quick return, locking circuits, circuits for hydraulic press, flow-controlled circuits etc. Analysis of various pneumatic circuits and pneumatic logic circuits.		
<b>UNIT 6</b>	<b>Design of hydraulic circuits and troubleshooting</b>	<b>8 HOURS</b>
Design of hydraulic circuits using hydraulic component manufacturer's product catalogue. Selection of various components. Hydraulic circuits drawing and specification of each components.		

**TEXT BOOK**


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1. Anthony Esposito, Fluid Power with Applications, PHI / Pearson Education, 2005, ISBN-10: 0135136903
2. Douglas M. Considine, Process instruments and Control Handbook McGraw-Hill, New York. 1985, ISBN-13: 978-0070124288
3. Majumdar, S.R., Pneumatic Systems – Principles and Maintenance, Tata McGraw Hill, 2007, ISBN-13: 0135176905

**REFERENCE BOOK**

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1. Shanmuga sundaram.K, Hydraulic and Pneumatic controls, S. Chand & Co, 2006, ISBN-13: 978-8121926355
2. Majumdar, S.R., Oil Hydraulics Systems- Principles and Maintenance, Tata McGraw Hill, 2001, ISBN-10: 0074637487
3. Micheal J, Pinches and Ashby, J.G., Power Hydraulics, Prentice Hall, 1989, ISBN-13: 978-0136874430
4. 99 Example of pneumatic application, Author G Prede & D. Schloz Publisher FESTO –AG Germany.

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Mechanical System Design
		<b>COURSE CODE</b>	ME442
		<b>COURSE CREDITS</b>	3
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	Nil	30	40	30	Nil	Nil	100

**PRE-REQUISITE :** Machine Design

**COURSE OBJECTIVES :**

ME442.CEO.1: To develop competency for system visualization and design.

ME442.CEO.2: To introduce student to optimum design and use optimization methods to design mechanical components.

ME442.CEO.3: To identify the mechanical systems and design it for specific applications.

**COURSE OUTCOMES :**

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

ME441.CO.1: Enlist the difference between component level design and system level design.

ME441.CO.2: Design various mechanical systems like pressure vessels, machine tool gear boxes, material handling systems, etc. for the specifications stated/formulated.

ME441.CO.3: Identify optimum design principles and apply it to mechanical components.

ME441.CO.4: Optimize design for efficient performance.

ME441.CO.5: Apply the concept of system design.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Machine Tool Gearbox</b>	<b>6 HOURS</b>
Machine tool gearboxes, design and its applications, basic considerations in design of drives, determination of variable speed range, graphical representation of speed and structure diagram, ray diagram, difference between numbers of teeth of successive gears in a change gear box.		
<b>UNIT 2</b>	<b>Optimum Design</b>	<b>6 HOURS</b>
Objectives of optimum design, adequate and optimum design, Johnson 's Method of optimum design, Primary design equations, subsidiary design equations and limit equations, optimum design of tension bar, transmission shaft and helical spring, Design for manufacture, assembly and safety.		
<b>UNIT 3</b>	<b>Statistical considerations in design</b>	<b>8 HOURS</b>
Frequency distribution-Histogram and frequency polygon, normal distribution - units of of central tendency and dispersion- standard deviation - population combinations - design for natural tolerances -design for assembly - statistical analysis of tolerances, mechanical reliability and factor of safety		
<b>UNIT 4</b>	<b>Belt conveyor system for material handling</b>	<b>8 HOURS</b>
System concept, basic principles, objectives of material handling system, unit load and containerization. Types of Belt conveyors, capacity of conveyor, rubber covered and fabric ply belts, belt tensions, conveyor pulleys, belt idlers, tension take-up systems, power requirement of horizontal belt conveyors.		
<b>UNIT 5</b>	<b>Cylinders and Pressure vessels</b>	<b>6 HOURS</b>
Thin and thick cylinders; failure criteria of vessels; Lame's equation; Clavarino's and Birnie's equation; Autofrettage and compound cylinders; Types of pressure vessels, Classification and Design of pressure vessel as per IS 2825, 1969. Shell and end closures. Effect of opening & nozzles in shell & covers. Types of pressure vessel support.		
<b>UNIT 6</b>	<b>I. C. Engine components</b>	<b>6 HOURS</b>
Introduction to selection of material for I. C. engine components, Design of cylinder and cylinder head, construction of cylinder liners, design of piston and piston-pins, piston rings, design of connecting rod. Design of crankshaft and crank-pin..		


### **TEXT BOOK**

1. Bhandari V.B. Design of Machine Elements, Tata McGraw Hill Pub. Co. Ltd., ISBN: 9339221125
2. Juvinal R.C, Fundamentals of Machine Components Design, Wiley, India., ISBN: 11118012895
3. Machine Design by Robert L.Norton, Tata Mc- Graw Hill Publication, ISBN: 013335671X
4. Patil S. P., Mechanical System Design, Jaico Publishing House, Mumbai, ISBN: 9788179923153
5. Ray T. K., Mechanical Handling of Materials, Asian Book Pvt. Ltd., Delhi, ISBN: 9788186299470

## REFERENCE BOOK

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1. Shigley J. E. and Mischke C.R., Mechanical Engineering Design, McGraw Hill Pub. Co, ISBN: 933922163X
2. M. F. Spotts, Mechanical Design Analysis, Prentice Hall Inc, ISBN: 8177584219
3. Black P.H. and O. Eugene Adams, Machine Design, McGraw Hill Book Co. Inc, ISBN: 9789339205218
4. Engineering Design by Dieter G.E. Tata Mc- Graw Hill Publication, ISBN: 0073398144
5. Design of Pressure vessel by Harve, CBS publishers and distributors, ISBN: 04422324489
6. IS-2825-1969 code for unfired pressure vessels, by J. Phillip Ellenberger, Mc Graw-Hill Education, ISBN: 0071436731
7. Rudenko N., Material Handling Equipment, PEACE Publishers, Moscow, ISBN: 0714702854
8. Joshi M. V., Mahajani V. V., Process Equipment Design, MacMillan India, Ltd.,Delhi, ISBN: 9789351380191
9. Ullman D.G., The Mechanical Design Process, McGraw Hill International Editions, ISBN: 9780999357804
10. Willium C. Orthwine, Machine Components Design I and II, Jaico Publishing House, Mumbai, ISBN: 0314242570
11. Johnson R.C.,Optimum Design of Mechanical Elements, John Wiley & Sons.Inc., London, ISBN: 0471038946

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Non-Conventional Machining
		<b>COURSE CODE</b>	ME443
		<b>COURSE CREDITS</b>	3
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	Nil	30	40	30	Nil	Nil	100

**PRE-REQUISITE :** Manufacturing Technology

**COURSE OBJECTIVES :**

ME443.CEO.1: To classify non-conventional machining processes.

ME443.CEO.2: To explain the principle, mechanism of metal removal of various non-conventional machining processes.

ME443.CEO.3: To outline various process parameters and their effect on the component, machined on various non-conventional machines.

ME443.CEO.4: To identify various applications of non-conventional machining processes

**COURSE OUTCOMES :**

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

ME443.CO.1: Illustrate the working of various non-conventional machining processes

ME443.CO.2: Apply the working principles and processing characteristics of non-conventional machining like EDM, ECM to the production of precision components

ME443.CO.3: Analyze mechanical, thermal and Electrochemical type non-conventional machining processes

ME443.CO.4: Examine the effect of material removal rate (MRR), Tool Wear and Surface roughness on work piece

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction</b>	<b>8 HOURS</b>
Introduction to Non-Conventional machining, Need for Non-Conventional machining process, Comparison between Conventional and non-Conventional machining, general classification Non-Conventional machining processes, classification based on nature of energy employed in machining, selection of non-Conventional machining processes, Specific advantages, limitations and applications of non-Conventional machining processes.		
<b>UNIT 2</b>	<b>Ultrasonic Machining (USM)</b>	<b>8 HOURS</b>
Introduction, Equipment and material process, Effect of process parameters: Effect of amplitude and frequency, Effect of abrasive grain diameter, effect of slurry, tool & work material. Tool Design. Process characteristics: Material removal rate (Numerical) tool wear, accuracy, surface finish, applications, advantages & limitations of USM. Case studies - Industrial.		
<b>UNIT 3</b>	<b>Abrasive Jet Machining (AJM), Water Jet Machining (WJM)</b>	<b>6 HOURS</b>
Abrasive Jet Machining (AJM): Introduction, Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, stand-off distance (SOD). Process characteristics- Material removal rate, Nozzle wear, accuracy & surface finish (Numerical). Applications, advantages & limitations of AJM. Water Jet Machining (WJM): Equipment & process, Operation, applications, advantages and limitations of WJM. Case studies - Industrial.		
<b>UNIT 4</b>	<b>Electrochemical Machining (ECM), Chemical Machining (CHM)</b>	<b>8 HOURS</b>
Electrochemical Machining (ECM): Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, surface finish (Numerical). Process parameters: Current density, Tool feed rate, Gap between tool & work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of electrolytes. ECM Tooling: ECM tooling technique & example, Tool & insulation materials. Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECG, ECH. Chemical Machining (CHM): Elements of the process: Resists (maskants), Etchants. Types of chemical machining process, chemical blanking process and chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process. Case studies - Industrial.		
<b>UNIT 5</b>	<b>Electrical Discharge Machining (EDM), Plasma Arc Machining (PAM)</b>	<b>8 HOURS</b>
Electrical Discharge Machining (EDM): Introduction, mechanism of metal removal, EDM equipment: spark erosion generator (relaxation type), dielectric medium-its functions & desirable properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone (Numerical). Advantages, limitations & applications of EDM, Electrical discharge grinding, Traveling wire EDM. Plasma Arc Machining (PAM): Introduction, non-thermal generation of plasma, equipment mechanism of metal removal, Plasma torch, process parameters, process characteristics. Safety precautions, applications, advantages and limitations. Case studies - Industrial.		



<b>UNIT 6</b>	<b>Laser Beam Machining (LBM), Electron Beam Machining (EBM)</b>	<b>6 HOURS</b>
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Laser Beam Machining (LBM): Introduction, generation of LASER, Equipment and mechanism of metal removal, LBM parameters and characteristics, Applications, Advantages & limitations. Electron Beam Machining (EBM): Introduction, Principle, equipment and mechanism of metal removal (Numerical), applications, advantages and limitations. Case studies - Industrial.

### **TEXT BOOK**

1. Ghosh and Mallik, Manufacturing Science, EWP Private Ltd, ISBN-13: 978-8176710633
2. V.K.Jain, Advance Machining Processes, Allied Publisher Bombay, ISBN-13: 978-8177642940
3. Advanced manufacturing processes, Hassan Abdel, Gabad El Hoffy, McGraw Hill, ISBN-13: 978-0071453349
4. Mishra, P. K., Non-Conventional Machining, The Institution of Engineers (India), Text Book Series, New Delhi, 1997, ISBN: 978-81-7319-522-8
5. Garry F. Benedict, Unconventional Machining Process, Marcel Dekker Publication, New York, 1987, ISBN 13: 9780824773526

### **REFERENCE BOOK**

1. Bannedict, G. F., Non-Traditional Machining Techniques, Marcel Decker, New York, 1990, ISBN-10: 9780824773526
2. Pandey P.C., Shan H.S., Modern machining processes, Tata McGraw-Hill Education, ISBN 10: 0070965536 / ISBN 13: 9780070965539
3. Weller E.J., Non-traditional machining processes, Society of Manufacturing Engineers, Publications, ISBN: 978-81-7319-522-8
4. The Science and Engineering of Micro-fabrication, Stephen P. Campbell, and Oxford University press, ISBN-10: 9780824773526 Pandey and Sha, Modern Manufacturing Process, Prentice Hall, New Jersey.
5. Fundamentals of Modern Manufacturing by M.P. Groover, John Wiley & Sons, 4th Edition ISBN-10: 9780824773526
6. Advanced Machining Processes by V. K. Jain, Narosa Publishing House, New Delhi, ISBN: 978-81-7319-522-8
7. Modern Machining Process / Pandey P.C. and Shah H.S./ TMH, ISBN 10: 0070965536
8. New Technology / Bhattacharya A/ The Institution of Engineers, India 1984.ISBN 13: 9780070965539
9. Advanced Machining Processes by V. K. Jain, Narosa Publishing House, New Delhi, ISBN-13: 978-0071453349

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY</b> <b>MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Enterprise Resource Planning
		<b>COURSE CODE</b>	ME444
		<b>COURSE CREDITS</b>	3
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	-	30	40	30	-	-	100

**PRE-REQUISITE :** Product Lifecycle Management

**COURSE OBJECTIVES :**

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ME444.CEO.1: To Describe the concept of ERP and the ERP model; define key terms; explain the transition from MRP to ERP; identify the levels of ERP maturity.

ME444.CEO.2: To Describe the elements of a value chain and explain how core processes relate.

ME444.CEO.3: To Identify the international issues that impact a worldwide implementation of ERP; identify the key technological considerations and infrastructure concerns in ERP implementation.

ME444.CEO.4: To Describe the strategic use of technology for ERP.

**COURSE OUTCOMES :**

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

ME444.CO.1: Comprehend the technical aspects of ERP systems

ME444.CO.2: Learn concepts of reengineering and how they relate to ERP system implementations

ME444.CO.3: Understand the steps and activities in the ERP life cycle

ME444.CO.4: Be able to identify and describe typical functionality in an ERP system

ME444.CO.5: Understand current trends and issues related to Enterprise Systems.


<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Introduction to ERP</b>	<b>5 HOURS</b>
Introduction, Evolution of ERP, Reasons for growth of ERP, Advantages / disadvantages of ERP, Evaluation of ERP, Various Modules in ERP		
<b>UNIT 2</b>	<b>ERP and Technology</b>	<b>6 HOURS</b>
ERP and Related Technologies-. Business Process Reengineering (BPR) -Data Warehousing-Data Mining-On-line Analytical Processing (OLAP) -Product Life Cycle Management (PLM) - Supply Chain Management (SCM) - Customer Relationship Management (CRM) -Advanced Technology and ERP Security		
<b>UNIT 3</b>	<b>Modules in ERP</b>	<b>8 HOURS</b>
Finance and Controlling, Sales and Distribution, Materials Management, Production Planning and Control, Quality Management, Planet Maintenance, Human Resource Business Processes Order To Cash, Procure To Pay, Plan To Produce, Make To Stock, Make To Order and Assemble To Order, Difference in Discrete and Process industries		
<b>UNIT 4</b>	<b>ERP Implementation</b>	<b>6 HOURS</b>
Planning Evaluation and selection of ERP systems - Implementation life cycle-ERP Implementation-Methodology and Frame work Training Data Migration People and Organization in implementation Consultants, Vendors and Employees.		
<b>UNIT 5</b>	<b>Supply chain management</b>	<b>7 HOURS</b>
Role of ERP in Supply Chain management, Supply Chain Drivers and Metrics, Supply Chain Performance, Managing Economics of Scale in a Supply Chain, Managing Uncertainty in a Supply Chain, Determining the Optimal level of Product Availability.		
<b>UNIT 6</b>	<b>Future Directions in ERP</b>	<b>6 HOURS</b>
Current trends in ERP, Changes in the ERP Implementations, Faster implementation methodologies, Web enabling, Maintenance of ERP Organizational and Industrial impact Success and Failure factors of ERP Implementation case studies.		

### **TEXT BOOK**

1. Thomas F. Wallace, Michael H. Kremzar, 'ERP Making It Happen', 2001, ISBN: 978-0-471-39201-9
2. V.K. Garg & N.K. Venkitakrishnan, ERP Ware: ERP Implementation framework, ISBN: 8120322541

### **REFERENCE BOOK**

1. V.K. Garg & N.K. Venkitakrishnan, ERP Concepts and Planning, Cengage, ISBN: 9788131525920
2. Alexis Leon, Enterprise Resource Planning, ISBN 8120322541
3. Rahul Altekar, Enterprise Resource Planning, ASIN: B00K7YGX2S
4. APIC's material on ERP

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>		<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>		Advanced Analysis
		<b>COURSE CODE</b>		ME451
		<b>COURSE CREDITS</b>		4
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
3	2	30	40	30	25	25	150

**PRE-REQUISITE :** Finite Element Analysis, Computational Fluid Dynamics

**COURSE OBJECTIVES :**

ME451.CEO.1: Conceptualize the programming skills.  
 ME451.CEO.2: Use a CFD tool effectively for practical problems and research.  
 ME451.CEO.3: Provides experience with a commercial FEM code and practical modeling exercises.  
 ME451.CEO.4: Prepare the students for research leading to higher studies and career in CAE industry using software tools.

**COURSE OUTCOMES :**

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

ME451.CO.1: Explain the inner workings of a finite element code for linear stress, displacement, temperature and modal analysis.  
 ME451.CO.2: Provide the mathematical foundations of the finite element formulation for engineering applications (solids, heat, fluids).  
 ME451.CO.3: Understand of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the CFD.  
 ME451.CO.4: Use commercial finite element analysis software to solve complex problems in solid mechanics and heat transfer  
 ME451.CO.5: Interpret the results of finite element analyses.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Fundamentals of Nonlinear Analysis</b>	<b>8 HOURS</b>
Basic of non-linear finite element analysis, Continuum mechanics, Nonlinear Heat Equation - 1 Dimension, Basic Nonlinear Continuum Mechanics of Solids, Total and Updated Lagrangian Approaches.		
<b>UNIT 2</b>	<b>Isoparametric Elements</b>	<b>8 HOURS</b>
Concept of isoparametric elements, Terms Isoparametric, super parametric and subparametric. Isoparametric formulation of bar element. Coordinate mapping - Natural coordinates, Area coordinates (for triangular elements), higher order elements (Lagrangean and serendipity elements). Convergence requirements- patch test, Uniqueness of mapping - Jacobian matrix. Numerical integration – 2- and 3-point Gauss Quadrature, full and reduced integration. Sub-modeling, substructuring.		
<b>UNIT 3</b>	<b>Dynamic Analysis</b>	<b>6 HOURS</b>
Types of dynamic analysis, general dynamic equation of motion, lumped and consistent mass, Mass matrices formulation of bar, truss and beam element.		
<b>UNIT 4</b>	<b>Introduction to Grid Generation</b>	<b>6 HOURS</b>
Undamped-free vibration: Eigenvalue problem, evaluation of eigenvalues and eigenvectors (characteristic polynomial technique). Structured and Unstructured Grids, General transformations of the equations, body fitted coordinate systems, Algebraic and Elliptic Methods, multi block structured grids, adaptive grids		
<b>UNIT 5</b>	<b>Introduction to Turbulence</b>	<b>8 HOURS</b>
Introduction, Statistical representation of turbulent flows: General Properties of turbulent quantities, Closure problem: Necessity of turbulence modeling, Reynolds average Navier stokes (RANS) equation		
<b>UNIT 6</b>	<b>Turbulence Modeling</b>	<b>6 HOURS</b>
Different types of turbulence model: Eddy viscosity models, Mixing lengths model, Turbulent kinetic energy and dissipation, The k- $\epsilon$ model, Advantages and disadvantages of k- $\epsilon$ model, Two-equation models: k- $\epsilon$ model and k- $\omega$ model, Reynolds stress equation model (RSM).		


<b>PRACTICAL: Perform the following experiments.</b>		
<b>PRACTICAL NO.01</b>		<b>4 HOURS</b>
Computer programs for (i) modal analysis and, (ii) stress analysis for 1-D beam (simply supported or cantilever beams) (Use Any programming language like C, C++, Matlab etc.)		
<b>PRACTICAL NO.02</b>	<b>Modal Analysis</b>	<b>4 HOURS</b>
Modal analysis of any machine component using FEA software		
<b>PRACTICAL NO.03</b>	<b>Transient Analysis</b>	<b>4 HOURS</b>
Transient structural analysis of any machine component using FEA software		
<b>PRACTICAL NO.04</b>	<b>Couplefied Analysis</b>	<b>6 HOURS</b>
Coupled Thermal-Structural Analysis using FEA software		
<b>PRACTICAL NO.05</b>	<b>Steady State Heat Conduction Using Fvm</b>	<b>4 HOURS</b>
Computer Program on One-dimensional steady state conduction using finite volume method (Use Any programming language like C, C++, Matlab etc.)		
<b>PRACTICAL NO.06</b>	<b>Forced Convection Under Turbulent Flow Conditions</b>	<b>6 HOURS</b>
Convection steady state heat transfer analysis of flow through pipe under turbulent flow conditions		

### **TEXT BOOK**

1. John D Anderson: Computational Fluid Dynamics- The Basics with Applications, McGraw-Hill, ISBN:9780070016859.
2. Atul Sharma, Introduction to Computational Fluid Dynamics: Development, Application and Analysis, Wiley, ISBN:9781119369189.
3. Suhas V. Patankar, Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation, ISBN:9780891165224.
4. A. W. Date, Introduction to Computational Fluid Dynamics, Cambridge Univ. Press, USA, ISBN:0521853265.
5. H. Versteeg, and W.Malalasekara, An Introduction to Computational Fluid Dynamics: The Finite Volume Method, Pearson, ISBN:9780131274983.

### **REFERENCE BOOK**

1. H. Tennekes and J. L. Lumley, A First Course in Turbulence, MIT Press, ISBN:9780262200196.
2. David C. Wilcox, Turbulence Modeling for CFD, DCW Industries, ISBN:97811928729082.
3. H. Schlichting and K. Gersten, Boundary-Layer Theory, Springer, ISBN:9783662529195.
4. T. J. Chung, Computational Fluid Dynamics, Cambridge University Press, ISBN:9780521769693.
5. J. N. Reddy, An Introduction to the Finite Element Method, Tata McGraw-Hill.ISMN-13-9780070513556
6. Gokhale N. S., Deshpande S. S., Bedekar S. V. and Thite A. N., —Practical Finite Element Analysis, Finite to Infinite, Pune, ISBN: 9788190619509.

 <b>MIT</b> (An autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>	<b>COURSE SYLLABI (2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Intelligent and high performance Robotics
		<b>COURSE CODE</b>	ME452
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/06/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	–	50	150

**PRE-REQUISITE :** Robotics Vision

**COURSE OBJECTIVES :**

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ME452.CEO.1: Describe methods of solving problems using Artificial Intelligence.  
 ME452.CEO.2: Percolate the concepts of optimal control for obtaining high performance.  
 ME452.CEO.3: Illustrate the concepts of Expert Systems and machine learning.

**COURSE OUTCOMES :**

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

ME452.CO.1: Classify different types of learning, planning and reasoning under AI methods.  
 ME452.CO.2: Identify appropriate AI methods to solve a given problem.  
 ME452.CO.3: Formalize a given problem in the language/framework of different AI methods.  
 ME452.CO.4: Explore and analyze diverse fields in robotic applications.


<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>ARTIFICIAL INTELLIGENCE FOR ROBOTICS</b>	<b>08 HOURS</b>
History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents. <b>PROBLEM SOLVING:</b> Solving problems by searching –Informed search and exploration–Constraint satisfaction problems–Adversarial search, knowledge and reasoning–knowledge representation – first order logic.		
<b>UNIT 2</b>	<b>Planning</b>	<b>08 HOURS</b>
Planning with forward and backward State space search – Partial order planning – Planning graphs–Planning with propositional logic – Planning and acting in real world.		
<b>UNIT 3</b>	<b>Reasoning</b>	<b>08 HOURS</b>
Uncertainty – Probabilistic reasoning–Filtering and prediction–Hidden Markov models–Kalman filters–Dynamic Bayesian Networks, Speech recognition, make decisions. Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics.		
<b>UNIT 4</b>	<b>Learning</b>	<b>08 HOURS</b>
Forms of learning – Knowledge in learning – Statistical learning methods –reinforcement learning, communication, perceiving and acting, Probabilistic language processing, perception.		
<b>UNIT 5</b>	<b>AI in Robotics</b>	<b>08 HOURS</b>
Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics Ariel robots- Collision avoidance-Robots for agriculture, mining, exploration, underwater, civilian and military applications, nuclear applications, Space applications		

<b>PRACTICAL:</b> Perform following experiments using		
<b>PRACTICAL NO.01</b>	<b>Capstone Project Development</b>	<b>18 HOURS</b>
Power management algorithms for energy harvesting sensing systems		

<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. Stuart Russell, Peter Norvig, “Artificial Intelligence: A modern approach”, Pearson Education, India2003. , ISBN : 978-0136042594.</li> <li>2. Negnevitsky, M, “Artificial Intelligence: A guide to Intelligent Systems”,. Harlow: Addison-Wesley, 2002., ISBN : 978-1408225745.</li> </ol>

<b>REFERENCE BOOK</b>
<ol style="list-style-type: none"> <li>1. David Jefferis, “Artificial Intelligence: Robotics and Machine Evolution”, Crabtree Publishing Company, 1992. , ISBN : 978-0778700463</li> </ol>



 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY</b> <b>MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Supply Chain Management
		<b>COURSE CODE</b>	ME453
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	30	40	30	25	25	150

**PRE-REQUISITE :** Operations Management

**COURSE OBJECTIVES :**

ME453.CEO.1: To study the concepts in supply chain management.  
 ME453.CEO.2: To understand different models in network design.  
 ME453.CEO.3: To analyze different financial ratios.  
 ME453.CEO.4: To review inventory management in Supply Chain Management.  
 ME453.CEO.5: To assess existing the supply chain for manufacturing company.

**COURSE OUTCOMES :**

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


ME453.CO.1: Identify the key elements and processes in supply chain.  
 ME453.CO.2: Discuss the designing, planning and operational decisions in Supply Chain Management.  
 ME453.CO.3: Predict the future developments in logistics and supply chain.  
 ME453.CO.4: Apply the critical components techniques in management in supply chain.  
 ME453.CO.5: Design supply chain network for manufacturing company.

<b>THEORY COURSE CONTENT</b>		
<b>UNIT 1</b>	<b>Supply Chain Management Concepts</b>	<b>8 HOURS</b>
Supply Chain: Concept, Objective. Decision Phases in Supply Chain. Process View of Supply Chain – Cycle View, Push/pull view, Supply Chain Performance – Achieving Strategic Fit. Types of Supply Chain – Responsive, Efficient, And Achieving Strategic Fit. Supply Chain Drivers – Facilities, Inventory, Transportation, Information. Importance of Supply Chain, Examples of Supply Chain		
<b>UNIT 2</b>	<b>Network Design in Supply Chain Management</b>	<b>8 HOURS</b>
Factors Influencing Distribution Network Design – Response time, Product variety, Product availability, Customer experience, Order visibility, Return ability. Logistics Modeling: Location – Allocation Models Multiple Facility Location Models: Baumol Wolf Method, Add & Construction Heuristic, Allocation Models: Transportation Model: Variants, Special Cases, Solution - Vogel’s Approximation Method, Optimality Methods – UV Method, Stepping Stone Method, Transshipment problems. Traveling Salesman Problem, Vehicle Routing Problem Factors Influencing Network Design Decisions – Strategic, Technological, Macroeconomic, Political, Infrastructure,		
<b>UNIT 3</b>	<b>Planning demand in Supply Chain</b>	<b>6 HOURS</b>
Managing Supply: Managing Capacity – time flexibility of workforce, seasonal workforce, subcontracting, use of dual facilities, design product flexibility into production processes. Managing Inventory – use common components across multiple products, build inventory of high demand of predictable demand products Managing Demand: Variable pricing, Forward buying. Collaborative Planning Forecasting & Replenishment, Demand Forecasting & Aggregate Planning in Supply Chain.		
<b>UNIT 4</b>	<b>Planning and managing Inventories in Supply Chain</b>	<b>6 HOURS</b>
Managing Economies of Scale: Cycle Inventory- Role in SC - Lot sizing for single product, multiple products or customers, Aggregating multiple products in single order Managing Uncertainty: Safety Inventory – Role in SC – Determine appropriate level of safety inventory Transportation & Inventory Cost Trade-off: Choice of Transportation Mode, Inventory Aggregation. Transportation cost and customer-responsiveness trade-off Pricing & Revenue Management in Supply Chain: Role, Revenue Management for Multiple Customer Segments, Seasonal Demand, Bulk & Spot Customers Economies of scale to exploit quantity discounts. Procurement Process. Sourcing Planning & Analysis Numerical on Inventory management in SCM.		
<b>UNIT 5</b>	<b>Co-ordination &amp; Technology in the Supply Chains</b>	<b>6 HOURS</b>
Co-ordination in Supply Chain: Lack of SC Coordination & Bullwhip Effect. Effect on Performance. Obstacles to SC Coordination. Manager Levers to Achieve Coordination. Information Technology and Supply Chain: Role of IT in SC Supply Chain IT Framework. E-business & Supply Chain Building Strategic Partnerships and Trust within a Supply Chain. Future of IT in Supply Chain. Cases on E-business and supply chains		
<b>UNIT 6</b>	<b>Case study of Supply Chain Management</b>	<b>6 HOURS</b>
Introduction, Nature of ratio analysis, Liquidity ratios, Leverage ratios, Activity ratios, Profitability ratios, Evaluation of a firm’s earning power. Comparative statements analysis. Simple numerical examples		

<b>PRACTICAL: Perform the following experiments.</b>		
<b>PRACTICAL NO.01</b>	<b>Case study of Supply Chain Management</b>	<b>18 HOURS</b>
<p>Student should choose company of their choice and should make detailed study of SCM model of the same company. Case study should mention about</p> <ol style="list-style-type: none"> <li>1. Allocation models</li> <li>2. Single or multiple facility</li> <li>3. Aggregate planning</li> <li>4. Inventory Management</li> <li>5. Software use Detailed report should be submitted for the same.</li> </ol>		
<b>PRACTICAL NO.02</b>	<b>Case study of Financial ratio analysis</b>	<b>10 HOURS</b>
<p>Student should choose the company and based on the balance sheet, should make case study based on different financial ratios. Report should be presented in group presentation.</p>		

<b>REFERENCE BOOK</b>
<ol style="list-style-type: none"> <li>1. Sunil Chopra &amp; Peter Meindl, Supply Chain Management - Strategy, Planning &amp; Operation – Pearson Education, ASIN: B071WJYFBF.</li> <li>2. Engineering Economy - Paul Degarmo, Macmillan Pub, Co. 2001, ISBN-00-23286008.</li> </ol>

<b>TEXT BOOK</b>
<ol style="list-style-type: none"> <li>1. Bowersox, Logistical Management - The Integrated Supply Chain Process, ISBN-10: 9780070435544</li> <li>2. Christopher, Logistics &amp; Supply Chain Management, Pearson Education, ISBN-13: 978-0273731122</li> <li>3. Logistics &amp; Supply Chain Management – Raghuram, ISBN-10: 0333933427</li> <li>4. Business Logistics / Supply Chain Management – Ronald Ballou, Peason Education, ISBN-13: 978-0130661845</li> </ol>

 <b>MIT</b> (An Autonomous Institute Affiliated to SPPU)	<b>Academy of Engineering</b>			<b>COURSE SYLLABI (2016 – 2020)</b>	
	<b>SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES</b>			<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FOURTH YEAR BACHELOR OF TECHNOLOGY</b>			<b>COURSE NAME</b>		Engineering Economics
			<b>COURSE CODE</b>		HP401
			<b>COURSE CREDITS</b>		2
<b>RELEASED DATE : 01/06/2019</b>			<b>REVISION NO</b>		0.0

<b>TEACHING SCHEME</b> (HOURS/WEEK)		<b>EXAMINATION SCHEME AND MARKS</b>					
		<b>THEORY</b>			<b>TUTORIAL/ PRACTICAL</b>	<b>PRESENTATION/ DEMONSTRATION</b>	<b>TOTAL</b>
<b>LECTURE</b>	<b>PRACTICAL</b>	<b>MSE</b>	<b>ESE</b>	<b>IA</b>			
1	NIL	NIL	50	20	NIL	NIL	70

**PRE-REQUISITE : NIL**

**COURSE OBJECTIVES :**

HP401.CEO.1: To enable the students to understand the basic concepts of Economics

HP401.CEO.2: To impart knowledge, with respect to practical applications of Economics .

**COURSE OUTCOMES :**

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

HP401.CO.1: The students would have understood the basic concepts of Economics.

HP401.CO.2: The students would have acquired knowledge, with respect to concepts, principles and practical applications of Economics, which govern the functioning of a firm/organization under different market conditions


HP401.CO.3: The course is designed to improve critical thinking, problem solving skills by using economic models and theories and predict economic relationships

HP401.CO.4: Students entering any profession in the workforce today must be able to utilize these basic economic principles. The course expected to develop critical understanding of current topics in economics and able to formulate their own opinions on economic issues

<b>THEORY</b>		
<b>UNIT 1</b>	<b>Introduction to Economics</b>	<b>6 HOURS</b>
Economic Issues and Concepts; How Economist Work ; Theory of Demand & Supply; Meaning, Determinants, Law of Demand and Supply, Equilibrium between Demand & Supply; Elasticity of demand, price elasticity, income elasticity, cross elasticity.		
<b>UNIT 2</b>	<b>Micro Economics</b>	<b>6 HOURS</b>
Revenue Concepts; Cost Concepts, Short run & Long run cost Concepts and curves, opportunity cost. Break even analysis; meaning, explanation, numerical. Markets; meaning, types of markets & their characteristics ( Perfect Competition, Monopoly, Monopolistic Competition , Oligopoly). <b>Further Reading:</b>		
<b>UNIT 3</b>	<b>Macro Economy</b>	<b>5 HOURS</b>
National Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP,NDP, Personal income, disposal income. Inflation; meaning, types, causes, measures to control. <b>Further Reading:</b>		
<b>UNIT 4</b>	<b>Indian Economy</b>	<b>5 HOURS</b>
Characteristics of an Indian Economy; Human Development Index(HDI); Concepts of Foreign Trade, Goods and Services Tax(GST); Micro Small and Medium Enterprise(MSME) ; Foreign Direct Investment(FDI);Unemployment: meaning, types, causes, remedies. <b>Further Reading:</b>		
<b>UNIT 5</b>	<b>Introduction to Banking &amp; Money Market</b>	<b>6 HOURS</b>
Banking; meaning, types, functions, Commercial Banks- Instruments in Operation of an Account, Central Bank- RBI; its functions, Concepts- CRR, Bank Rate, Repo Rate, Reverse Repo rate, SLR; Introduction to Money and Capital Market , Introduction to Fiscal policy- meaning and tools. <b>Further Reading:</b>		

#### **REFERENCE BOOKS**

1. R.Paneerselvam :Engineering Economics, , PHI publication ISBN : 978-81-203-5172-1
2. Robbins S.P. and Decenzo David A :Fundamentals of Management: Essential Concepts and Applications, Pearson Education, ISBN-13: 9780133499919
3. N Gregory Mankiw : Economics: Principles of Economics, Cengage Learning ISBN-10: 1305585127
4. L.M. Prasad: Principles and Practices of Management ISBN-10: 9351610500; ISBN-13: 978-9351610502
5. Tripathy and Reddy :Principles of Management ISBN, 1259050572, 9781259050572
6. Dr. K. K. Dewett & M. H. Navalur, S. Chand :Modern Economic Theory ISBN, : 9788121924634 .

 <b>Academy of Engineering</b> (An autonomous Institute Affiliated to SPPU)		<b>COURSE SYLLABI</b> <b>(2016 – 2020)</b>	
<b>SCHOOL OF MECHANICAL AND CIVIL ENGINEERING</b>		<b>W.E.F</b>	<b>AY: 2019 - 2020</b>
<b>FINAL YEAR BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING</b>		<b>COURSE NAME</b>	Major Project - II
		<b>COURSE CODE</b>	ME432
		<b>COURSE CREDITS</b>	4
<b>RELEASED DATE : 01/01/2019</b>		<b>REVISION NO</b>	0.0

TEACHING SCHEME		EXAMINATION SCHEME AND MARKS					
(HOURS/WEEK)		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
-	8	-	-	-	100	50	150

**PRE-REQUISITE :** Major Project– I

**COURSE OBJECTIVES :**

ME432.CEO.1: To follow the standard guideline to meet the objective for development of Project.  
 ME432.CEO.2: To test rigorously before deployment of Systems  
 ME432.CEO.3: To Verify and Validate the work Undertaken  
 ME432.CEO.4: To Consolidate the work and preparation of final report

**COURSE OUTCOMES :**

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

ME432.CO1: Show the evidence of independent evaluation.  
 ME432.CO2: Critically analyzed the result and their implementation methodology.  
 ME432.CO3: Validate the results with standard tools and techniques.  
 ME432.CO4: Understand the importance of documentation and report writing.

#### PREAMBLE:

objective of this Major Project-II to implement the full and final project and the report. After The remaining project work which consist of selection of approach / methodology / tools and techniques, Designing, installation, results and performance evaluation. Also includes the comparative analysis and validation of result. Should prepare the Project report as per format for satisfactory completion of work certified by concern project advisor and dean. .

**It is desirable to prepare and publish the conference or journal paper or IPR and publish with peer reviewed publishing agency. 10 marks will be awarded.:**

**Follow the guideline and formats as mentioned in guideline document.(Annexure-II):**

#### GUIDELINES:

In Project Work Stage-II, the student shall complete the remaining project work which consists of Selection of Methodology, Tools and Technology, Installations, Design, Implementations, testing, Results, performance analysis if applicable (discussions using data tables per parameter considered for the improvement with existing/known algorithms/systems) and comparative analysis and validation of results and conclusions. The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is the duly certified by the concerned advisor and Dean of the school.

**It is desirable to prepare and publish the conference or journal paper or IPR and publish with peer reviewed publishing agency. 10 marks will be awarded.**

**Follow the guideline and formats as mentioned in guideline document.(Annexure-II)**

#### TIMELINE

1. Presentation of Project Review- 3 Project Progress Monitoring DRC review – (Week 5th )
2. Presentation of Project Review – 4 Project Progress Monitoring and Report Preparation –( Week-8th)
3. Internal Examination/ Project Expo: Project-2 Demonstration and presentation- (Week 10th )
4. External Examination: Project-2 Demonstration and Presentation- (End semester-Week 12th or 13th )

#### ASSESSMENT

1. Internal Assessment
  - a. Project Review -3 Progress Monitoring - 30 Marks
  - b. Project Review -4 Progress Monitoring and Report Preparation -30 Marks
  - c. Project Expo/ Examination- Evaluation Presentation and Demonstration- 30 Marks
  - d. Paper publication/presentation/IPR -10 Marks
2. Examination: Final Demonstration and presentation
  - a. Project presentation: 15 Marks
  - b. Project design / execution / demonstration : 20 Marks
  - c. Project Report preparation and documentation: 15 Marks



**MIT ACADEMY OF ENGINEERING, ALANDI**

**An Autonomous Institute Affiliated to**

**Savitribai Phule Pune University**

**Curriculum**

**For**

**Final Year**

**Bachelor of Technology in**

**Mechanical Engineering**

**(Amendments for Semester Long Internship)**

**2016-2020**

**(With Effect from Academic Year: 2019-2020)**

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**MIT****An Autonomous Institute Affiliated to SPPU****Academy of  
Engineering****CURRICULUM STRUCTURE  
(2016 - 2020)****1. ELIGIBILITY:**

- I. No live backlogs
- II. CGPA of 8.50 and above
- III. If Recruiter/s (MNCs) have asked for semester long internship to the selected student/s (before joining the organization after his / her graduation), then in special case recruited students can apply for the same. (Only criteria-I should be satisfied by the student)

Only students satisfying the above criteria can be permitted for semester-long internship in any MNCs / R&D laboratories such as DRDO, NCL, NEERI, CDAC and Institutions like IITs/ NITs / International institutes of repute.

**2. DEADLINES:**

For the current batch, the applications must be submitted by 30, November 2019 by all students desired to go for the semester long internship.

**3. APPLICATION PROCEDURE:**

The student must submit a proposal of the semester-long internship including details of the organization along with the details of the project in brief, copy of their CV and copies of mark sheet to the respective school Corporate Relations (CR) coordinator. The application must be as per the format given below.

### Application for Internship Program

Sr. No.	Particulars	
1	Name of the applicant (in bold letters)	
2	Gender	
3	School	
4	Date of Birth & Age (as on date)	
5	Roll Number & PRN	
6	Address for correspondence with mobile / telephone number and email-id	
7	Name & address of the Institute / Industry	
8	Core Domain of Institute / Industry	
9	Contact details Supervisor / HR Mobile / Telephone number and email-id	
10	Period of internship	24-26 weeks
11	Details of the Project proposed	

### Signatures

<b>Student</b>	<b>School Internship Coordinator</b>
<b>Approved by:</b>	
<b>No. of credits proposed</b>	6 / 10
<b>Dean – School of _____ Engineering</b>	MIT AOE Seal
<b>Date:</b>	

#### 4. RULES AND CONDITIONS:

- I. Sponsored project should be along the same track of the minor (Open Elective) chosen by the student. (desirable)
- II. Semester long internship is applicable only in the 8<sup>th</sup> semester. The distribution of credits for the VIII semester is as follows

DC	Department Core	4 Credits
DE	Department Elective	3 Credits
OE	Open Elective	4 Credits
HSS	Humanities & Social science	2 Credits
SDP	Skill development and Project	4 Credits
- III. For a student who are opting for a semester long internship, 10 credits (OE, HSS and SDP) will be awarded if OE is part of the internship otherwise 6 credits will be awarded.
- IV. The equivalence courses for the DC, DE and OE are floated by the Schools.
- V. The credits of DC, DE and OE should be earned through MOOC courses.
- VI. If a student is not able to successfully earn the credits of the DC / DE / OE within the stipulated time, they will not be eligible for graduation in the same academic year.

#### 5. ASSESSMENT METHOD:

Credits for the semester-long internship need to be earned by the students by the following assessment in front of the panel.

- I. The Panel for the evaluation should be 3 members (if 3 credits) or 4 members (if 5 credits). The composition of the team would be as follows.
  - a. Dean, Respective School
  - b. Project Guide
  - c. CR Coordinator / Project Coordinator
  - d. Project Guide (Industry)
  - e. The domain expert (In case of 5 credits, as per the minor specialization)
- II. Presentation I at the end of 45<sup>th</sup> day and presentation II at the end of 90<sup>th</sup> day from the start of the project combined to a total weightage of 5 credits (**3 credits if OE is exempted**). It can be possible to do through Skype, if acceptable to the panel. **In Grade card it will be mentioned as SLIP – Project Design.**
- III. Presentation at the end of the Internship Work and Final Internship Report after the completion of the Internship Work combined for a total weightage of 5 credits (**3 credits if OE is exempted**) and should be as per the template). **In Grade card it will be mentioned as SLIP – Project Implementation.**

## **5.2 ASSESSMENT METHOD FOR OTHER COURSES RUN THROUGH INSTITUTE LMS:**

Credits for the courses run through Go-Webinar will be assessed using the following methods.

- I. There will be SIX assignments (one per unit) to be submitted through the moodle. This will have a weightage of 30% of the total score. This contributes to the IA for the course.
- II. There will be SIX quizzes (one per unit) to be conducted through moodle. This will have a weightage of 30% of the total score. This contributes to the ISE for the course.
- III. One FINAL presentation to be done at the end and evaluated by a team of THREE members including the Course Champion, Instructor and any other nominated member by the respective School Dean. This will have a weightage of 40% of the total score. This contributed for the ESE of the course.

**SCHOOL OF MECHANICAL & CIVIL  
ENGINEERING**

**W. E. F** : **2019-20** (PART B)

**FINAL YEAR BACHELOR OF TECHNOLOGY  
MECHANICAL ENGINEERING**

**RELEASE DATE** : **01/12/2018**

**REVISION NO.** : **0.0**

**SEMESTER: VII**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC11	ME401	Heating Ventilation & Air Conditioning	3	2	4
2.	DE1	ME41#	Discipline Elective	3	--	3
3.	OE3	ME42#	Open Elective	3	2	4
4.	HSS7	HP402	Sociology	2	--	2
5.	HSS8/ SDP7	HP403/ ME40#	Business Strategies / Piping Design/ Six Sigma/ Energy Audit	--	2	1
6.	SDP8	ME402	Project – I	--	8	4
7.	SDP9	ME404	Summer Internship	--	--	4
<b>TOTAL</b>				11	14	22

**SEMESTER: VIII (SLIP not inline with the Open elective)**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC12	ME431	Noise Vibration & Harshness@	3	2	4
2.	DE2	ME44#	Discipline Elective	3	--	3
3.	OE4	ME45#	Open Elective@	3	2	4
4.	SEMESTER LONG INTERNSHIP – Project Design			--	6	3
5.	SEMESTER LONG INTERNSHIP – Project Implementation			--	6	3
<b>TOTAL</b>				7	20	17

*L: Lecture, P: Practical*

**CURRICULUM STRUCTURE  
(2016 - 2020)**

**SCHOOL OF MECHANICAL & CIVIL  
ENGINEERING**

**W. E. F** : **2019-20 (PART C)**

**FINAL YEAR BACHELOR OF TECHNOLOGY  
MECHANICAL ENGINEERING**

**RELEASE DATE** : **01/12/2018**

**REVISION NO.** : **0.0**

**SEMESTER: VII**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC11	ME401	Heating Ventilation & Air Conditioning	3	2	4
2.	DE1	ME41#	Discipline Elective	3	--	3
3.	OE3	ME42#	Open Elective	3	2	4
4.	HSS7	HP402	Sociology	2	--	2
5.	HSS8/ SDP7	HP403/ ME40#	Business Strategies / Piping Design/ Six Sigma/ Energy Audit	--	2	1
6.	SDP8	ME402	Project – I	--	8	4
7.	SDP9	ME404	Summer Internship	--	--	4
<b>TOTAL</b>				11	14	22

**SEMESTER: VIII (SLIP not inline with the Open elective)**

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC12	ME431	Noise Vibration & Harshness@	3	2	4
2.	DE2	SWAYAM/ NPTEL	Discipline Elective	3	--	3
3.	SEMESTER LONG INTERNSHIP – Project Design			--	10	5
4.	SEMESTER LONG INTERNSHIP – Project Implementation			--	10	5
<b>TOTAL</b>				6	22	17

L: Lecture, P: Practical

@ - Courses run through institute LMS.

<b>DEPARTMENT ELECTIVE ON MOOCS PLATFORM</b>			
<b>SR. NO.</b>	<b>COURSE DETAILS</b>	<b>MOOC DETAILS</b>	<b>NO. OF WEEKS</b>
1.	Fundamentals of Industrial Oil Hydraulics and Pneumatics By Prof. R.N. Maiti, IIT Kharagpur	SWAYAM	8
2.	Design for Quality, Manufacturing and Assembly by Prof. Palaniappaan Ramu, IIT Madras	SWAYAM	12
3.	Non Traditional Abrasive Machining Processes- Ultrasonic, Abrasive Jet and Abrasive Water Jet Machining by Prof. Asimava Roy Choudhury, IIT Kharagpur	SWAYAM	8
4.	Enterprise Resource Planning (ERP) BY Sara Behdad, The State University of New York	COURSERA	4