MIT | Academy of Engineering

MIT ACADEMY OF ENGINEERING, ALANDI

An Autonomous Institute Affiliated to

Savitribai Phule Pune University

Curriculum

For

Bachelor of Technology

In

Chemical Engineering

(Choice Based Credit System)

2019-2023

BoS Chairman
Dean,
School of Chemical Engineering

CHAIRMAN
BOS-Chemical Engineering
MIT Academy of Engineering
(An Autonomous Institute)

Member Secretary
Academic Council
Dean, Academics

DEAN (ACADEMICS)
MIT Academy of Engineering
Alandi (D.), Pune-412 105

Chairman
Academic Council
Director, MITAoE

CHAIRMAN
Academic Council
MIT Academy of Engineering
(An Autonomous Institute)

MIT | Academy of Engineering

MIT ACADEMY OF ENGINEERING, ALANDI

An Autonomous Institute Affiliated to

Savitribai Phule Pune University

Curriculum

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BoS Chairman	Member Secretary	Chairman
Dean,	Academic Council	Academic Council
School of Chemical Engineering	Dean, Academics	Director, MITAoE

MIT Academy of Engineering, Alandi, Pune

An Autonomous Institute affiliated to Savitribai Phule Pune University

CURRICULUM FRAMEWORK (Revision 2019)

CHEMICAL ENGINEERING

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

COURSE DISTRIBUTION: SEMESTER WISE									
S.N.	TYPE OF COURSE	NO. OF COURSES/SEMESTER							TOTAL
		1	2	3	4	5	6	7	8	
1.	Natural Science (NSC)	2	2	1						**5**
2.	Engineering Science (ESC)	4	3		1					**8**
3.	Discipline Core (DC)			3	3	3	3	1	1	**14**
4.	Discipline Elective (DE)							1	1	**2**
5.	Open Elective (OE)					1	1	1		**3**
6.	Humanities and Social Science (HSS)		1		1	1	1		2	**6**
7.	Skill Development and Project (SDP)	3	2	2	2	3	1	13	3	**2**
TOTAL		**6**	**6**	**7**	**7**	**7**	**7**	**6**	**5**	**51**
Audit Course			**1**	**2**	**1**	**1**				**5**

CREDIT DISTRIBUTION: SEMESTER WISE											
1 Lecture hour = 1 Credit **2 Lab Hours = 1 Credit** **1 Tutorial Hour = 1 Credit**											
S.N.	TYPE OF COURSE	NO. OF CREDITS/SEMESTER								TOTAL	%
		1	2	3	4	5	6	7	8		
1.	Natural Science (NSC)	8	8	4						**20**	**12.5**
2.	Engineering Science (ESC)	13	9		4					**26**	**16.25**
3.	Discipline Core (DC)			12	12	11	11	4	4	**54**	**33.75**
4.	Discipline Elective (DE)							3	3	**6**	**3.75**
5.	Open Elective (OE)					4	4	4		**12**	**7.5**
6.	Humanities and Social Science (HSS)	0	2		2	2	2		4	**12**	**7.5**
7.	Skill Development and Project (SDP)			5	3	4	4	10	4	**30**	**18.75**
TOTAL		**21**	**19**	**21**	**21**	**21**	**21**	**21**	**15**	**160**	**100**

CREDITS				
1 Lecture Hour = 1 Credit, 2 Lab Hours = 1 Credit, 1 Tutorial Hour = 1 Credit				
SL. NO.	YEAR	SEMESTER		TOTAL
		1	2	
1.	First Year	21	19	**40**
2.	Second Year	21	21	**42**
3.	Third Year	21	21	**42**
4.	Final Year	21	15	**36**
TOTAL				**160**

CONTACT HOURS				
SL. NO.	YEAR	SEMESTER		TOTAL
		1	2	
1.	First Year	29/27	28/30	**57**
2.	Second Year	31	31	**62**
3.	Third Year	27	30	**57**
4.	Final Year	25	20	**45**
TOTAL				**221**

ABBREVATIONS		
1.	MSE	Mid Semester Exam
2.	ESE	End Semester Exam
3.	IA	Internal Assessment
4.	T/P	Term Work / Practical
5.	DM	Demonstration
6.	L	Lecture
7.	P	Practical
8.	T	Tutorial
9.	Lab	Laboratory

MIT | Academy of Engineering An Autonomous Institute Affiliated to SPPU	COURSE STRUCTURE (2019 - 2023)		
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	W.E.F	:	2019-2020
FIRST YEAR BACHLEOR OF TECHNOLOGY	RELEASE DATE	:	01/07/2019
	REVISION NO.	:	1.0

SEMESTER: I (Version I)

INDUCTION PROGRAM: 3 WEEKS

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	CREDIT
			L	P	T	MSE	ESE	IA	T/P	DM		
NSC1	AS105	Calculus and Differential Equations	3	-	1	30	30	40	50	-	150	4
NSC2	AS106	Engineering Physics	3	2	-	30	30	40	50	-	150	4
ESC1	EX102	Electrical & Electronic Engineering	3	2	-	30	30	40	50	-	150	4
ESC2	ME104	Engineering Graphics	2	4	-	-	60	40	100	-	200	4
ESC3	CS101	Logic Development - C	1	4	-	-	40	-	100	-	140	3
ESC4	ME105	Experimental Tools and Techniques	-	4	-	-	-	-	40	60	100	2
TOTAL			**12**	**16**	**1**	**90**	**190**	**160**	**390**	**60**	**890**	**21**

SEMESTER: II (Version I)

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	CREDIT
			L	P	T	MSE	ESE	IA	T/P	DM		
NSC3	AS107	Statistics and Integral Calculus	3	-	1	30	30	40	50	-	150	4
NSC4	CH101	Science of Nature	3	2	-	30	30	40	50	-	150	4
ESC5	CV102	Applied Mechanics	3	2	-	30	30	40	50	-	150	4
ESC6	CS102	Application Programming - Python	1	4	-	-	40	-	100	-	140	3
HSS1	HP103/4/5	English for Engineers /(German/Japanese)	0	4	-	-	-	-	100	-	100	2
ESC7	ME106	Design Thinking	-	4	-	-	-	-	40	60	100	2
HSS2	HP106	Indian Constitution	1	-	-	-	-	-	-	-	Audit	
TOTAL			**11**	**16**	**1**	**90**	**130**	**120**	**390**	**60**	**790**	**19**

MIT | Academy of Engineering An Autonomous Institute Affiliated to SPPU	COURSE STRUCTURE (2019 - 2023)		
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	W.E.F	:	2019-2020
FIRST YEAR BACHLEOR OF TECHNOLOGY	RELEASE DATE	:	01/07/2019
	REVISION NO.	:	1.0

SEMESTER: I (Version II)

INDUCTION PROGRAM: 3 WEEKS

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	CREDIT
			L	P	T	MSE	ESE	IA	T/P	DM		
NSC1	AS105	Calculus and Differential Equations	3	-	1	30	30	40	50	-	150	4
NSC2	CH101	Science of Nature	3	2	-	30	30	40	50	-	150	4
ESC1	CV102	Applied Mechanics	3	2	-	30	30	40	50	-	150	4
ESC2	CS101	Logic Development - C	1	4	-	-	40	-	100	-	140	3
HSS1	HP103/4/5	English for Engineers /(German/Japanese)	0	4	-	-	-	-	100	-	100	2
SDP2	ME106	Design Thinking	-	4	-	-	-	-	40	60	100	2
TOTAL			**10**	**16**	**1**	**90**	**130**	**120**	**390**	**60**	**790**	**19**

SEMESTER: II (Version II)

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						
PE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTA L	CREDIT
			L	P	T	MSE	ESE	IA	T/P	DM		
NSC3	AS107	Statistics and Integral Calculus	3	-	1	30	30	40	50	-	150	4
NSC2	AS106	Engineering Physics	3	2	-	30	30	40	50	-	150	4
ESC1	EX102	Electrical & Electronic Engineering	3	2	-	30	30	40	50	-	150	4
ESC2	ME104	Engineering Graphics	2	4	-	-	60	40	100	-	200	4
ESC6	CS102	Application Programming - Python	1	4	-	-	40	-	100	-	140	3
ESC4	ME105	Experimental Tools and Techniques	-	4	-	-	-	-	40	60	100	2
HSS2	HP106	Indian Constitution	1	-	-	-	-	-	-	-	Audit	
TOTAL			**13**	**16**	**1**	**90**	**190**	**160**	**390**	**60**	**890**	**21**

MIT | Academy of Engineering Autonomous Institute Affiliated to SPPU	COURSE STRUCTURE (2019 - 2023)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2020-2021
SECOND YEAR BACHLEOR OF TECHNOLOGY IN CHEMICAL ENGINEERING	RELEASE DATE	:	01/07/2020
	REVISION NO.	:	1.0

SEMESTER: III

INTERNSHIP (CH200)

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
ESC6	ME221	Material Engineering	3	2	-	35	35	30	0	50	150	4
DC01	CH221	Material and Energy Balance	3	0	-	35	35	30	0	0	100	3
DC02	CH222	Inorganic and Analytical Chemistry	3	2	-	35	35	30	50	0	150	4
DC03	CH223	Momentum transfer	3	2	-	35	35	30	50	0	150	4
DC04	CH224	Chemical Engineering Thermodynamics	3	0	-	35	35	30	0	0	100	3
SDP1	ET235	Rapid Prototyping	0	4	-	0	0	0	0	75	75	2
SDP2	CH230	Minor Project - Design	0	2	-	0	0	0	0	50	50	1
ESC7	CV203	Environmental Science	1	0	-	-	-	-	-	-	Audit	
TOTAL			**16**	**12**	**0**	**175**	**175**	**150**	**100**	**175**	**775**	**21**

SEMESTER: IV

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
NSC5	AS203	Applied Mathematics	3	2	-	35	35	30	50	0	150	4
DC05	CH231	Heat Transfer	3	2	-	35	35	30	50	0	150	4
DC06	CH232	Advanced Chemistry	3	2	-	35	35	30	50	0	150	4
DC07	CH233	Mass Transfer	3	2	-	35	35	30	50	0	150	4
HSS3	HP202	Professional Skills	0	4	-	0	0	25	0	50	75	2
SDP3	ET224	Digital Prototyping	0	4	-	0	0	0	0	75	75	2
SDP4	CH240	Minor Project - Implementation	0	2	-	0	0	0	0	50	50	1
HSS4	HP203	Liberal Learning	1	0	-	-	-	-	-	-	Audit	
TOTAL			**13**	**18**	**0**	**140**	**140**	**145**	**200**	**175**	**800**	**21**

MIT | Academy of Engineering Autonomous Institute Affiliated to SPPU	COURSE STRUCTURE (2019 - 2023)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2021-2022
THIRD YEAR BACHLEOR OF TECHNOLOGY IN CHEMICAL ENGINEERING	RELEASE DATE	:	01/07/2021
	REVISION NO.	:	1.0

SEMESTER: V

INTERNSHIP (CH300)

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
DC08	CH341	Chemical Engineering Operations	3	2	-	35	35	30	50	0	150	4
DC09	CH342	Separation Process	3	2	-	35	35	30	50	0	150	4
DC10	CH343	Chemical Reaction Engineering	3	2	-	35	35	30	50	0	150	4
OE01	CH351/ CH352	Process Engineering / Energy Technology	3	2	-	35	35	30	50	0	150	4
HSS5	HP304	Project Management	2	0	-	0	50	25	0	0	75	2
SDP5	CH344	Skill Development Lab (CFD)	0	4	-	0	0	25	50	0	75	2
SDP6	CH345	Project Design	0	4	-	0	0	25	0	50	75	2
TOTAL			**14**	**16**	**0**	**140**	**190**	**195**	**250**	**50**	**825**	**22**

SEMESTER: VI

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
DC11	CH361	Process Dynamics and Control	3	2	-	35	35	30	50	0	150	4
DC12	CH362	Chemical Equipment Design I	3	2	-	35	35	30	50	0	150	4
DC13	CH363	Chemical Process Technology	3	0	-	35	35	30	0	0	100	3
OE02	CH371 / CH372	Process Modelling and Simulation / Energy Modeling and Simulation	3	2	-	35	35	30	50	0	150	4
HSS6	HP305	Employability and Career Development	0	4	-	0	0	25	0	50	75	2
SDP7	CH364	Skill Development Lab (ASPEN ONE)	0	4	-	0	0	25	50	0	75	2
SDP8	CH365	Project Implementation	0	4	-	0	0	25	0	50	75	2
TOTAL			**12**	**18**	**0**	**140**	**140**	**195**	**200**	**100**	**775**	**21**

MIT | Academy of Engineering Autonomous Institute Affiliated to SPPU	COURSE STRUCTURE (2019 - 2023)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2022-2023
FINAL YEAR BACHLEOR OF TECHNOLOGY IN CHEMICAL ENGINEERING	RELEASE DATE	:	01/07/2022
	REVISION NO.	:	1.0

SEMESTER: VII

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
DC14	CH461	Plant Design and Piping	1	4	-	0	30	20	50	25	125	3
DE01	CH48#	Refer Annexure	3	0	-	35	35	30	0	0	100	3
OE03	CH471 / CH472	Process Intensification and Integration / Energy Management and Audit	3	2	-	35	35	30	50	0	150	4
SDP9	CH463	Skill Development Lab (Aspen EDR)	0	4	-	0	0	25	50	0	75	2
SDP10	CH470	Project Evaluation	0	8	-	0	0	50	0	100	150	4
SDP11	CH400	Summer Internship	-	-	-	-	-	-	-	150	150	4
TOTAL			**7**	**18**	**0**	**70**	**100**	**155**	**150**	**275**	**750**	**20**

SEMESTER: VIII (PART A)

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
DC15	CH462	Chemical Equipment Design II	3	2	-	35	35	30	50	0	150	4
DE02	CH49#	Refer Annexure	3	0	-	35	35	30	0	0	100	3
HSS7	HP405	Engineering Economics	2	0	-	0	50	25	0	0	75	2
HSS8	HP406	Psychology	2	0	-	0	50	25	0	0	75	2
SDP12	CH480	Capstone Work	-	8	-	0	0	50	0	100	150	4
TOTAL			**10**	**10**	**0**	**70**	**170**	**160**	**50**	**100**	**550**	**15**

SEMESTER: VIII (PART B SEMESTER LONG INTERNSHIP)												
COURSE			**TEACHING SCHEME**			**EXAMINATION SCHEME AND MARKS**						**CREDIT**
TYPE	**CODE**	**NAME**	**Hour/Week**			**THEORY**			**PRACT**		**TOTAL**	
			L	P	T	MSE	ESE	IA	T/P	DM		
DC15	CH462	Chemical Equipment Design II	3	2	-	35	35	30	50	0	150	4
DE02	CH49#	Refer Annexure	3	0	-	35	35	30	0	0	100	3
SDP13	CH467	Semester Long Internship Design	-	-	-	-	-	-	-	150	150	4
SDP14	CH468	Semester Long Internship Implementation	-	-	-	-	-	-	-	150	150	4
TOTAL			**6**	**2**	**0**	**70**	**70**	**60**	**50**	**300**	**550**	**15**

Discipline Elective (DE): 2 Courses and 6 Credits			
Sl. No.	**Course Code**	**Course Name**	**Course Credits**
1.	CH481	Introduction to Paint Technology	3
	CH483	Petroleum Refining Technology	
	CH484	Biochemical Engineering	
	CH485	Environmental Engineering	
2.	CH491	Paint Manufacturing Process	3
	CH493	Petrochemical Technology	
	CH494	Bioprocess Technology	
	CH495	Chemical Process Safety	
	CHSWAYAM01	Membrane Technology	
	CHSWAYAM02	Environmental Quality Monitoring and Analysis	
	CHSWAYAM03	Biomass Conversion and Biorefinery	

Natural Science (NSC): 5 Courses and 20 Credits			
Sl. No.	**Course Code**	**Course Name**	**Course Credits**
1.	AS105	Calculus and Differential Equations	4
2.	AS106	Engineering Physics	4
3.	CH101	Science of Nature	4
4.	AS107	Statistics and Integral Calculus	4
5.	AS203/04	Applied Mathematics	4

Humanities and Social Science (HSS): 6 Courses and 12 Credits			
Sl. No.	**Course Code**	**Course Name**	**Course Credits**
1.	HP103	English for Engineers	2
	HP104	German	
	HP105	Japanese	
Audit	HP106	Indian Constitution	Audit
2.	HP202	Professional Skills	2
Audit	HP203	Liberal Learning	Audit
3.	CS361	Project Management	2
4.	HP305	Employability and Career Development	2
5.	HP405	Engineering Economics	2
6.	HP406	Psychology	2

Engineering Science (ESC): 8 Courses and 26 Credits			
Sl. No.	**Course Code**	**Course Name**	**Course Credits**
1.	EX102	Electrical and Electronics Engineering	4
2.	CV102	Applied Mechanics	4
3.	ME104	Engineering Graphics	4
4.	ME105	Experimental Tools and Techniques	2
5.	ME106	Design Thinking	2
6.	CS101	Logic Development - C Programming	3
7.	CS102	Application Programming - Python	3
8.	ME221	Material Engineering	4
	IT221	Engineering Informatics	
Audit	CV203	Environmental Sciences	Audit

Discipline Core (DC): 15 Courses and 56 Credits			
Sl. No.	**Course Code**	**Course Name**	**Course Credits**
1.	CH221	Material and Energy Balance	3
2.	CH222	Inorganic and Analytical Chemistry	4
3.	CH223	Momentum Transfer	4
4.	CH224	Chemical Engineering Thermodynamics	3
5.	CH231	Heat Transfer	4
6.	CH232	Advanced Chemistry	4
7.	CH233	Mass Transfer	4
8.	CH341	Chemical Engineering Operations	4
9.	CH342	Separation Process	4
10.	CH343	Chemical Reaction Engineering	4
11.	CH361	Process Dynamics and Control	4
12.	CH362	Chemical Equipment Design I	4
13.	CH363	Chemical Process Technology	3
14.	CH461	Plant Design and Piping	3
15.	CH462	Chemical Equipment Design II	4

Skill Development and Project (SDP): 14 Courses and 36 Credits			
Sl. No.	**Course Code**	**Course Name**	**Course Credits**
1.	ET235	Rapid Prototyping	2
2.	CH230	Minor Project – Design	1
3.	ET224	Digital Prototyping	2
4.	CH240	Minor Project – Implementation	1
5.	CH344	Skill Development Lab (CFD)	2
6.	CH345	Project Design	2
7.	CH364	Skill Development Lab (Aspen ONE)	2
8.	CH365	Project Implementation	2

9.	CH463	Skill Development Lab (Aspen EDR)	2
10.	CH470	Project Evaluation	4
11.	CH400	Summer Internship	4
12.	CH480	Capstone Work	4
13.	CH467	Semester Long Internship – Design	4
14.	CH468	Semester Long Internship - Implementation	4
Audit	CH200	SY Summer Internship	Audit
Audit	CH300	TY Summer Internship	Audit

List of Skill Development Courses				
Programme Name	Skill Development Course 1	Skill Development Course 2	Skill Development Course 3	Skill Development Course 4
Chemical	CFD	ASPEN ONE	Aspen EDR	Plant Design and Piping
Civil	REVIT/ MS EXCEL	ETABS	Open Road Designer/Water GEMs	CFD / QGIS
Computer and Information Technology	CPP/Core Java	RHA I/ Web Technology	Adv. Java/ .Net Core/RHA II	AWS cloud services/ Android App Development
Mechanical	Industrial Measurements & Instrumentation	Computer Aided Product Design	Mechanical Simulations	Object Oriented Programing with Python
Electronics Engineering and ENTC	Data Structures and Algorithms	OOP JAVA / C++	Networking Data Science	EMB Linux/Cloud Computing/System Verilog

Open Electives (OE): 03 Courses and 12 Credits							
Programme Name	**Open Track Name**	**Semester V**		**Semester VI**		**Semester VII**	
		Course Code	**Course Name**	**Course Code**	**Course Name**	**Course Code**	**Course Name**
Chemical Engineering	Process Engineering	CH351	Process Engineering	CH371	Process Modeling and Simulation	CH471	Process Intensification and Integration
	Energy Engineering	CH352	Energy Technology	CH372	Energy Modeling and Simulation	CH472	Energy Management and Audit
Civil Engineering	Project Management	CV325	Planning and Management	CV332	Operation Research	CV422	Financial Management
	Environmental Engineering	CV326	Solid Waste Management	CV333	Unit Operations for Liquid Waste/Effluent Treatment	CV423	Environmental Impact assessment and Climate Change
Computer Engineering	Data science	CS351	Descriptive Analytics	CS354	Predictive Analysis	CS461	Big Data Analytics
	Artificial Intelligence and Machine Learning	CS352	Artificial Intelligence	CS355	Machine Learning	CS462	Deep Learning
	Cloud Computing	CS353	Cloud Computing Foundation	CS356	Cloud Native Application Development	CS463	Cloud Native DevOps
Electronics Engineering	Robotics and Automation	ME352	Robot Fundamentals and Kinematics	EX371	Robot Dynamics and Control	EX471	AI in Robotics

Open Electives (OE)							
Programme Name	**Open Track Name**	**Semester V**		**Semester VI**		**Semester VII**	
		Course Code	**Course Name**	**Course Code**	**Course Name**	**Course Code**	**Course Name**
Electronics & Tele-communication	Healthcare Technology	ET351	Fundamentals of Healthcare Technology	ET371	Healthcare Informatics	ET471	AI in Healthcare
	Internet of Things	ET352	IoT Architecture and Sensors	ET372	IoT Network & Protocols	ET472	Data Management and Analytics
Information Technology	Computer Security	IT351	Cryptography and System Security	IT352	Cyber Security and Forensics	IT461	Ethical Hacking & Cyber Laws
Mechanical Engineering	Computer Aided Engineering	ME351	Finite Element Analysis	ME361	Computational Fluid Dynamics	ME491	Advanced Fluid Dynamics
	Robotics and Automation	ME352	Robot Fundamentals and Kinematics	EX371	Robot Dynamics and Control	EX471	AI in Robotics
	Automobile Engineering	ME354	Automobile System Design	ME364	Vehicle Dynamics	ME494	Autotronics and e-Vehicles
Entrepreneurship Cell	Innovation and Entrepreneurship	HP311	Foundational Course in Entrepreneurship	HP312	Advanced Course in Entrepreneurship	HP411	Startup and Incubation

MIT | Academy of Engineering

MIT ACADEMY OF ENGINEERING, ALANDI

An Autonomous Institute Affiliated to

Savitribai Phule Pune University

Curriculum

For

First Year

Bachelor of Technology

2019-2023

(With Effect from Academic Year: 2019-2020)

MIT | Academy of Engineering An Autonomous Institute Affiliated to SPPU	COURSE STRUCTURE (2019 - 2023)		
SCHOOL OF ENGINEERING SCIENCES AND HUMANITIES	W.E.F	:	2019-2020
FIRST YEAR BACHLEOR OF TECHNOLOGY	RELEASE DATE	:	01/07/2019
	REVISION NO.	:	1.0

SEMESTER: I (Version I)

INDUCTION PROGRAM: 3 WEEKS

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
			Hour/Week			THEORY			PRACT		TOTAL	
TYPE	CODE	NAME	L	P	T	MSE	ESE	IA	T/P	DM		
NSC1	AS105	Calculus and Differential Equations	3	-	1	20	40	40	50	-	150	4
NSC2	AS106	Engineering Physics	3	2	-	20	40	40	50	-	150	4
ESC1	EX102	Electrical and Electronics Engineering	3	2	-	20	40	40	50	-	150	4
ESC2	ME104	Engineering Graphics	2	4	-	-	60	40	100	-	200	4
ESC3	CS101	Logic Development-C Programming	1	4	-	-	40	-	100	-	140	3
SDP1	ME105	Experimental Tools and Techniques	-	4	-	-	-	-	40	60	100	2
TOTAL			**12**	**16**	**1**	**60**	**220**	**160**	**390**	**60**	**890**	**21**

SEMESTER: II (Version I)

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
			Hour/Week			THEORY			PRACT		TOTAL	
PE	CODE	NAME	L	P	T	MSE	ESE	IA	T/P	DM		
NSC3	AS107	Statistics and Integral Calculus	3	-	1	20	40	40	50	-	150	4
NSC4	CH101	Science of Nature	3	2	-	20	40	40	50	-	150	4
ESC4	CV102	Applied Mechanics	3	2	-	20	40	40	50	-	150	4
HSS1	HP103/4/5	English for Engineers /(German/Japanese)	0	4	-	-	-	-	100	-	100	2
ESC5	CS102	Applications Programming -Python	1	4	-	-	40	-	100	-	140	3
SDP2	ME106	Design Thinking	-	4	-	-	-	-	40	60	100	2
HSS2	HP106	Indian Constitution	1	-	-	-	-	-	-	-	Audit	
TOTAL			**11**	**16**	**1**	**60**	**160**	**120**	**390**	**60**	**790**	**19**

MIT | Academy of Engineering An Autonomous Institute Affiliated to SPPU	COURSE STRUCTURE (2019 - 2023)		
SCHOOL OF ENGINEERING SCIENCES AND HUMANITIES	W.E.F	:	2019-2020
FIRST YEAR BACHLEOR OF TECHNOLOGY	RELEASE DATE	:	01/07/2019
	REVISION NO.	:	1.0

SEMESTER: I (Version II)

INDUCTION PROGRAM: 3 WEEKS

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
NSC1	AS105	Calculus and Differential Equations	3	-	1	20	40	40	50	-	150	4
NSC4	CH101	Science of Nature	3	2	-	20	40	40	50	-	150	4
ESC4	CV102	Applied Mechanics	3	2	-	20	40	40	50	-	150	4
HSS1	HP103/4/5	English for Engineers /(German/Japanese)	0	4	-	-	-	-	100	-	100	2
ESC3	CS101	Logic Development-C Programming	1	4	-	-	40	-	100	-	140	3
SDP2	ME106	Design Thinking	-	4	-	-	-	-	40	60	100	2
TOTAL			**10**	**16**	**1**	**60**	**160**	**120**	**390**	**60**	**790**	**19**

SEMESTER: II (Version II)

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
PE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
NSC3	AS107	Statistics and Integral Calculus	3	-	1	20	40	40	50	-	150	4
NSC2	AS106	Engineering Physics	3	2	-	20	40	40	50	-	150	4
ESC1	EX102	Electrical and Electronics Engineering	3	2	-	20	40	40	50	-	150	4
ESC2	ME104	Engineering Graphics	2	4	-	-	60	40	100	-	200	4
ESC5	CS102	Applications Programming -Python	1	4	-	-	40	-	100	-	140	3
SDP1	ME105	Experimental Tools and Techniques	-	4	-	-	-	-	40	60	100	2
SS2	HP106	Indian Constitution	1	-	-	-	-	-	-	-	Audit	
TOTAL			**13**	**16**	**1**	**60**	**220**	**160**	**390**	**60**	**890**	**21**

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Calculus and Differential Equations
	COURSE CODE	AS105
	COURSE CREDITS	4
RELEASE DATE : 01/07/2019	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	TUTORIAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	1	20	40	40	50	NIL	150

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

AS105.CEO.1: Classify and solve first order and first degree ordinary differential equations.
AS105.CEO.2: Categorize and inspect the applications of first order differential equations.
AS105.CEO.3: Inspect and solve linear differential equations of second and higher order.
AS105.CEO.4: Apply the concepts of partial differentiation.
AS105.CEO.5: Demonstrate an understanding towards the applications of partial differentiation.
AS105.CEO.6: Identify and classify first order linear and nonlinear partial differential equations.

COURSE OUTCOMES :

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

AS105.CO.1: Solve first order and first degree ordinary differential equations.
AS105.CO.2: Analyze and solve real world phenomenon governed by first order ordinary differential equations.
AS105.CO.3: Apply concepts of linear differential equations of second and higher order to solve different systems in engineering world.
AS105.CO.4: Infer the problems based on properties of partial differentiation.
AS105.CO.5: Examine the applications of partial differentiation.
AS105.CO.6: Solve and examine the solution of partial differential equations by theoretical methods.

THEORY COURSE CONTENT		
UNIT 1	**Ordinary Differential Equations of First Order and First Degree**	**6 HOURS**
Exact differential equations, Differential equations reducible to exact form-Integrating factors, Linear differential equations, Differential equations reducible to linear form.		
UNIT 2	**Applications of Ordinary Differential Equations of First Order and First Degree**	**6 HOURS**
Orthogonal Trajectories, Newton's law of cooling, Growth & Decay, Electric circuits, Chemical applications- Mixing problems.		
UNIT 3	**Linear Differential Equation of Second Order and Higher Order**	**7 HOURS**
General solutions of linear differential equations with constant coefficients, Method of variation of parameters, Equations reducible to linear differential equations with constant coefficients: Cauchy and Legendre's linear differential equation, Simultaneous linear differential equations, Applications.		
UNIT 4	**Partial Differentiation**	**7 HOURS**
Partial Differentiation: Introduction, Chain rule, Total derivative, Change of variables, Homogeneous functions, Euler's Theorem, Differentiation of Implicit functions.		
UNIT 5	**Applications of Partial Differentiation**	**6 HOURS**
Jacobian, Jacobian of Implicit functions, Partial derivative of an implicit function using Jacobians, Functional dependence, Maxima and Minima of functions of two variables.		
UNIT 6	**Partial Differential Equations**	**7 HOURS**
Introduction and formation of partial differential equation, solution of a partial differential equation, equations solvable by direct integration, Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method.		

TUTORIAL		
TUTORIAL NO.01		**1 HOURS**
Exact differential equations, Differential equations reducible to exact form-Integrating factors.		
TUTORIAL NO.02		**1 HOURS**
Linear differential equations, Differential equations reducible to linear form.		
TUTORIAL NO.03		**1 HOURS**
Orthogonal Trajectories, Newton's law of cooling, Growth & Decay		
TUTORIAL NO.04		**1 HOURS**
Electric circuits, Chemical applications- Mixing problems.		

TUTORIAL NO.05		**1 HOURS**
General solutions of linear differential equations with constant coefficients, Method of variation of parameters.		
TUTORIAL NO.06		**1 HOURS**
Cauchy and Legendre's linear differential equation, Simultaneous linear differential equations, Applications.		
TUTORIAL NO.07		**1 HOURS**
Partial Differentiation: Introduction, Chain rule, Total derivative, Change of variables.		
TUTORIAL NO.08		**1 HOURS**
Homogeneous functions, Euler's Theorem, Differentiation of Implicit functions.		
TUTORIAL NO.09		**1 HOURS**
Jacobian, Jacobian of Implicit functions, Partial derivative of an implicit function.		
TUTORIAL NO.10		**1 HOURS**
Functional dependence, Maxima and Minima of functions of two variables.		
TUTORIAL NO.11		**1 HOURS**
Introduction and formation of partial differential equation, solution of a partial differential equation, equations solvable by direct integration.		
TUTORIAL NO.12		**1 HOURS**
Linear differential equations of first order, Non-linear differential equations of first order, Charpit's method.		

TEXT BOOK

1. Dr. B.V. Ramana, Higher Engineering Mathematics, 5 th edition, Tata McGraw Hill, 2017, ISBN: 978-0-07-063419-0
2. B.S. Grewal, Higher Engineering Mathematics, 44 th edition, Khanna Publications, 2018, ISBN: 978-81-933284-9-1

REFERENCE BOOK

1. G.B. Thomas, Maurice D. Weir, Joel R. Hass, Thomas' Calculus, 12 th edition, Pearson Education, 2002, ISBN: 9789332519091
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10 th edition, Wiley Eastern Ltd., 2015, ISBN: 13: 9788126554232
3. R.K. Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing house , 2010, ISBN: 8173194203.
4. Peter V. O'Neil, Advanced Engineering Mathematics, 7 th edition, Cenage Learning, 2012, ISBN: 13: 9788131503102.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Engineering Physics
	COURSE CODE	AS106
	COURSE CREDITS	4
RELEASE DATE : 01/07/2019	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	1	20	40	40	50	NIL	150

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

AS106.CEO.1: Make students identify the basic concept of measurements and to formulate problems in physical and mathematical terms.

AS106.CEO.2: Analyze and understand the behavior of light as a wave and get acquaint with different applications in Physics.

AS106.CEO.3: Apply the concept of behavior of light and understand the polarization phenomena.

AS106.CEO.4: Classify and understand the difference of classical mechanics and quantum mechanics.

AS106.CEO.5: Derive the basic laws governing the motion of quantum particles.

AS106.CEO.6: Apply the concept of quantum mechanics to different applications and supplement the reasoning.

COURSE OUTCOMES :

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

AS106.CO.1: Evaluate the importance of order of all physical quantities and compare the order of size of different objects.

AS106.CO.2: Apply the theoretical knowledge of optics to understand the physics behind engineering applications.

AS106.CO.3: Apply that light is transverse in nature.

AS106.CO.4: Demonstrate the necessity of quantum mechanics and the distinction between the domains of classical and quantum mechanics.

AS106.CO.5: Evaluate and apply the Schrödinger's equation to the motion of an electron orbiting round the shell.
AS106.CO.6: Apply the concepts of Quantum Physics in different branches of engineering.

THEORY COURSE CONTENT		
UNIT 1	**Measurement and importance of span (order) of physical quantities**	**6 HOURS**
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. Length-scale and time-scale of specific physical phenomenon.		
UNIT 2	**Optics (Interference and Diffraction of Light)**	**7 HOURS**
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.		
UNIT 3	**Polarization of Electromagnetic wave**	**6 HOURS**
Polarization of electromagnetic wave, Production and analysis of polarized electromagnetic wave, Optical Activity, Specific Rotation due to optically active solutions, Application of Polarized light.		
UNIT 4	**Quantum Mechanics-I**	**7 HOURS**
Shortcomings or failure of Classical Mechanics with specific example of blackbody radiation, Planck's quantum law of blackbody radiation, Matter-waves, De-Broglie's concept of matter waves, Heisenberg's Uncertainty Principle, Wave-function, Physical significance of wave function.		
UNIT 5	**Quantum Mechanics-II**	**8 HOURS**
Schrodinger's 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 Bohr's atomic model.		
UNIT 6	**LASER and Optical Fiber**	**5 HOURS**
Stimulated Absorption, Stimulated Emission of light and its comparison with spontaneous emission, Probabilities of stimulated absorption and emission of light (Einstein's coefficients), Principle and working of LASER (Ruby Laser), Application of LASER in optical fiber communication.		

PRACTICAL		
PRACTICAL NO.01	**Significant Figures**	**2 HOURS**
Determination of the mass of electron (me) upto specified significant numbers.		
PRACTICAL NO.02	**Interference of Light Waves**	**2 HOURS**
Calculate the refractive index of a given liquid using Newton Rings' Experiment.		
PRACTICAL NO.03	**Diffraction of Light Waves**	**2 HOURS**
Determination of the line density of a diffraction grating using Laser.		
PRACTICAL NO.04	**Interference of Light Waves**	**2 HOURS**
Calculate the wavelength of Sodium light source using Michelson Interferometer.		
PRACTICAL NO.05	**Phase and Phase Difference**	**2 HOURS**
Determination of the phase-difference between two given positions on the path of simple pendulum in periodic motion.		
PRACTICAL NO.06	**Bohr's Atomic Model**	**2 HOURS**
Verification of Bohr's atomic model using Frank and Hertz experiment.		
PRACTICAL NO.07	**Polarization**	**2 HOURS**
Determination of the specific rotation of a sugar solution of a given concentration.		
PRACTICAL NO.08	**Stoke's Law**	**2 HOURS**
Calculation of wavelength of a laser beam using Lloyd's mirror arrangement.		
PRACTICAL NO.09	**Division of Amplitude of Light Waves**	**2 HOURS**
Determination of Radius of Curvature of a given planoconvex lens using Newton's Rings apparatus.		
PRACTICAL NO.10	**Diffraction as a Particular Case of Interference**	**2 HOURS**
Calculation of wavelength of different colors present in a white light.		

TEXT BOOK

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

REFERENCE BOOK

1. Alan S Morris, Butterworth Heinemann, Measurement and Instrumentation Principles,3rd Edition, Butterworth-heinmann,2001, ISBN 0750650818
2. Ajoy Ghatak ,Optics, 6th Edition Tata Mc Graw Hill Publishing Company. Ltd., 2016, ISBN-10-9339220900

3. Jenkins & White, Fundamentals of Optics, 4th Edition,Mc Graw Hill Science,2016, ISBN-0070853460.

4. Arthur Beiser, Shobit Mahajan, S. Rai. Choudhary ,Concepts of Modern Physics-,6th Edition, Mc Graw Hill Education (India) Pvt. Ltd., 2009, ISBN-10- 0070151555.

5. L I Schiff ,Quantum Mechanics,3rd Edition, Tata Mc Graw Hill Education (India) Pvt. Ltd.,ISBN-10- 0070856435, ISBN- 13- 9780070856431.

6. PAM Dirac,Principles of Quantum Mechanics,4th Edition, CBS publishers and Distributors,2004, ISBN-10- 0195671074, ISBN- 13- 978019567107

7. D J Griffiths, Introduction to Quantum Mechanics,2nd Edition,Cambridge India ,2016,ISBN-9781316646513.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Electrical and Electronics Engineering
	COURSE CODE	EX102
	COURSE CREDITS	4
RELEASE DATE : 01/07/2019	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		**EXAMINATION SCHEME AND MARKS**					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	20	40	40	50	NIL	150

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

EX102.CEO.1: Impart knowledge of single-phase AC circuit and use of renewable energy systems.
EX102.CEO.2: Explain relations in three-phase systems and study power measurement methods.
EX102.CEO.3: Explain power supply components, electronic devices.
EX102.CEO.4: Summarize various Digital systems and application.
EX102.CEO.5: Build the knowledge of measuring system and signal conditioning circuits.
EX102.CEO.6: Get acquainted with different electrical machines.

COURSE OUTCOMES :

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

EX102.CO.1: Develop Renewable energy system (PV) & power factor improvement circuits.
EX102.CO.2: Distinguish behavior of three phase circuits & power measurement methods.
EX102.CO.3: Analyze analog circuits.
EX102.CO.4: Design Digital circuits.
EX102.CO.5: Demonstrate the use of Instrumentation system in various fields.
EX102.CO.6: Identify electrical machines used in typical domestic and industrial sector Application.

THEORY COURSE CONTENT		
UNIT 1	**AC Circuits**	**7 HOURS**
Energy Scenario, General structure of electrical power systems, A.C. fundamentals, RMS and average value, R-L,R-C,RLC series and parallel circuits, phasor diagram, power triangle and power factor, measures to improve power factor and its effects on Power system and consumer. Work, Power & Energy, costing of electricity, Application of Renewable Energy Systems, Design of PV system (offgrid), Battery selection and its series parallel connections		
UNIT 2	**Three Phase Circuit and Power Measurement**	**7 HOURS**
Three phase voltage generation and its waveform, Star and delta balanced systems, Relationship between phase and line quantities, phasor diagram, power in a three phase circuits, three phase 4 wire system, Difference between neutral and ground conductors, Safety measures in electrical system, types of wiring, Active and Reactive Power measurement in single and three phase balanced system.		
UNIT 3	**Power Supply and Electronics Devices**	**7 HOURS**
Rectifiers and Power Supplies, Elements of IC Regulated Power Supply, Clipper, Clamper. BJT - Structure and operation, CE, CB, CC configurations, biasing methods, DC Load Line, Transistor as a switch and Amplifier. Opto-electronic devices – Photo conductive cell, Photo Voltaic cell.		
UNIT 4	**Digital Systems**	**7 HOURS**
Logic gates, Boolean algebra, KMap, SOP representation. Combinational circuit Design: Adder, Subtractor, MUX, DMUX, Comparator, Code converter Sequential circuit: Flip-Flop, Registers and Synchronous & Asynchronous Counters. Microprocessor and Microcontroller based systems.		
UNIT 5	**Measuring System**	**7 HOURS**
Elements of measuring system, Sensors & Transducers –Temperature, Flow, Pressure, Level, IR, Speed & LVDT, Op-Amp – IC 741 pin configuration, Op-amp parameters, Inverting, Non- Inverting & Differential configuration. Applications: Summing & Difference amplifier, Comparator, Voltage follower.		
UNIT 6	**Electrical Machines**	**7 HOURS**
Construction of Transformer, principle of operation, EMF equation, VA Rating, Efficiency and Voltage regulation, OC/SC Test on Transformer. Construction, principle of operation and types of DC motor, Speed Control, characteristics equation, PMDC, BLDC, Universal motor, Single phase Induction Motor, Stepper motor, Application of Electrical Motors in domestic and Industrial sector.		

PRACTICAL:		
PRACTICAL NO.01	**Kirchhoff's laws and Superposition theorem**	**2 HOURS**
To develop a circuit for Kirchhoff's laws and Superposition theorem. To build and test both theorems.		
PRACTICAL NO.02	**Single Phase Energy (Watt-hour) Measurement.**	**2 HOURS**
To measure energy and power factor. To examine improvement in the power factor. To estimate and compare energy consumption with energy meter.		
PRACTICAL NO.03	**R-L-C series A.C. Circuit**	**2 HOURS**
To calculate exact values of R, L and C for variations in X_L and X_C (3 cases) To justify the lagging and Leading nature for the three cases. To find power losses in total R, L and C and verify with total power consumed.		
PRACTICAL NO.04	**Verification of relation between Line and Phase quantities in Star and Delta Circuits.**	**2 HOURS**
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 between Line and Phase Quantities. To connect Bulb load in Delta connection and verify the relation between Line and Phase Quantities.		
PRACTICAL NO.05	**Power Measurement in Three Phase Balanced Circuit and Single Phase Circuit.**	**2 HOURS**
To measure active and reactive power by Two wattmeter method in three phase circuit. To measure reactive power by One wattmeter method in three phase circuit.		
PRACTICAL NO.06	**Open Circuit & Short Circuit Test on a Single Phase Transformer**	**2 HOURS**
To find iron losses and no load circuit parameters To find full load copper losses and Equivalent circuit parameters To determine efficiency and regulation of transformer at various different loading conditions.		
PRACTICAL NO.07	**Speed Control of D.C. Shunt Motor**	**2 HOURS**
To vary field current and measure speed To vary armature voltage and measure speed Draw conclusion from both the methods through graphs.		
PRACTICAL NO.08	**Step Angle Measurement of Stepper Motor.**	**2 HOURS**
To become familiar with the properties of Stepper Motor. To calculate the step angle of motor.		
PRACTICAL NO.09	**Electronics Components and Measuring Instruments**	**2 HOURS**
To study Passive components - Resistors, Capacitors & Inductor. To test semi-conducting components - Diode, BJT To measure various electronic quantities using CRO, Function generator, DMM		

PRACTICAL NO.10	D.C. Regulated Power Supply	2 HOURS
To design 12V/ 9V/ 5V IC based DC regulated power supply (Theoretically). To test and observe waveforms at various stages on CRO and measure the voltage using DMM.		
PRACTICAL NO.11	**BJT as a Switch and Amplifier**	**2 HOURS**
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.		
PRACTICAL NO.12	**Combinational Digital Circuits**	**2 HOURS**
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.		
PRACTICAL NO.13	**Sequential Digital Circuits**	**2 HOURS**
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.		
PRACTICAL NO.14	**OP-AMP Applications**	**2 HOURS**
To verify operations of inverting and non-inverting amplifier for various gain factors. To verify application of OP-AMP as summing and difference amplifier. To verify the application of OP-AMP as voltage follower.		
PRACTICAL NO.15	**Sensors and Transducer**	**2 HOURS**
To study and verify operation of LVDT. To study and verify the operation of Temperature sensors. (PT100, LM35)		
PRACTICAL NO.16	**Design and Simulate using MULTISIM (Min.2)**	**2 HOURS**
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.		

In addition to total 8 Experiments, two case study reports must be attached with Laboratory Course Record.

TEXT BOOK

1. Edward Hughes, "Electrical and Electronic Technology" 10th Edition, Pearson India, 2011, ISBN-13: 978-8131733660
2. Thomas L. Floyd, "Electronics Devices & Circuits", 5th Edition, Pearson Education India, 1998, ISBN-13: 978-0136491385.
3. A. Anand Kumar, "Fundamentals of Digital Circuits", 4th Edition, Prentice Hall of India, 2016, ISBN-13: 978-8120352681

REFERENCE BOOK

1. V. N. Mittle and Arvind Mittal, "Basic Electrical Engineering", 2nd Edition, McGraw Hill Education, 2005, ISBN-13: 978-0070593572.
2. D. P. Kothari, I. J. Nagrath, "Electric Machines", 4th Edition, McGraw Hill, 2010, 978-0070699670.
3. Paul Horowitz, Winfield Hill, "The Art of Electronics", 3rd Edition, Cambridge University press, ISBN-13: 978-0521809269.
4. Thomas E. Kissell, "Industrial Electronics", 3rd Edition, Prentice Hall of India, 2003, ISBN-13:9788120322608
5. B. H. Khan, "Non-Conventional Energy Resources", 2nd Edition, Tata McGraw Hill, 2009, ISBN-13: 978-0070142763.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Engineering Graphics
	COURSE CODE	ME104
	COURSE CREDITS	4
RELEASE DATE : 01/07/2019	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
2	4	NIL	60	40	60	40	200

PRE-REQUISITE : NIL

COURSE OBJECTIVES:

ME104.CEO.1: To impart knowledge about principles/methods related to projections of one, two and three-dimensional objects.
ME104.CEO.2: To develop & apply visualization skills to simple Objects.
ME104.CEO.3: To expose students to computer aided drafting tools.

COURSE OUTCOMES:

The students after completion of the course will be able,

ME104.CO.1: Develop and/or comprehend a simple engineering drawing in both First and Third angle orthographic projections.
ME104.CO.2: Interpret engineering drawings.
ME104.CO.3: Apply visualization skills to development of surfaces.
ME104.CO.4: Analyze engineering drawings.
ME104.CO.5: Decide annotations for two dimensional drawings.
ME104.CO.6: Create manual drawing & CAD data using SP46 standards.

THEORY COURSE CONTENT		
UNIT 1	**Visual Thinking and Solid Geometry**	**12 HOURS**
Essentials of engineering graphics including technical sketching, Projection of Line, Plane, Solid.		
UNIT 2	**Orthographic Projections and Sectional Views**	**4 HOURS**
Reference Planes, Types of Orthographic Projections, Sectional Orthographic Projections, Sectional Views, Missing views.		
UNIT 3	**Isometric Projections**	**4 HOURS**
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.		
UNIT 4	**Development of Surfaces**	**2 HOURS**
Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.		
UNIT 5	**Auxiliary Projections**	**2 HOURS**
Auxiliary Planes- Auxiliary Vertical Plane, Auxiliary Inclined Plane, Symmetrical Auxiliary View, Unilateral Auxiliary View, bilateral Auxiliary View		
UNIT 6	**Freehand Sketching and Technical Drawing**	**4 HOURS**
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.		

PRACTICAL: **Each Assignment carries 2 questions to be draws on A2 Size Drawing Sheet**		
ASSIGNMENT NO.1	Projection of Lines	**4 HOURS**
Two Questions on line inclined to both planes		
ASSIGNMENT NO.2	Projection of Planes	**2 HOURS**
Two Questions on plane inclined to both planes		
ASSIGNMENT NO.3	Projection of Solids	**2 HOURS**
Two Questions on solid inclined to both planes		
ASSIGNMENT NO.4	Orthographic Projections	**4 HOURS**
Two Questions on Orthographic Projection of Simple Mechanical Element		
ASSIGNMENT NO.5	Development of surface	**4 HOURS**
Two Questions on Development of regular Solids		
ASSIGNMENT NO.6	Isometric View	**6 HOURS**
Two Questions on Isometric view of Mechanical Element		

ASSIGNMENT NO.7	Auxiliary View	**4 HOURS**
Two Questions on auxiliary view of Mechanical Element		
PRACTICAL: **Each Assignment carries 2 questions to be drawn on 2D CAD software package**		
PRACTICAL NO. 1	Absolute & incremental drafting	**4 HOURS**
Drawing of two sketches using absolute and incremental commands		
PRACTICAL NO. 2	Draw commands, Modify commands, Array, fillet, offset commands	**6 HOURS**
Drawing of four sketches using draw & modify commands		
PRACTICAL NO. 3	Project Drafting	**2 HOURS**
Drafting of a small project using all drafting standards		
PRACTICAL: **Each Assignment carries 2 questions to be drawn on 3D CAD software package**		
PRACTICAL NO. 4	Sketching, Solid Modeling, Assembly	**12 HOURS**
Modeling of five Mechanical models using 3D Software package		
PRACTICAL NO. 5	Project Modeling	**4 HOURS**
Modeling of small Mechanical Project of Minimum three components		

TEXT BOOK

1. Dhanajay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD", TMH Publishing Co Ltd, 5th Edition, 2012, (ISBN 13: 9780070648371)
2. Basant Agarwal and C M Agarwal, "Engineering Drawing", TMH Publishing co Ltd, 2nd Edition 2013, (ISBN13: 978-1-259-06288-9)
3. K C John, "Engineering Graphics for Degree", PHI learning pvt. Ltd. New Delhi,2009, (ISBN: 97881-203-3788-6)
4. R. K. Dhavan, A TextBook of Engineering Drawing, S Chand and co ltd., New Delhi India, 5Th Edition, 2012, ISBN 13: 9788121914314

REFERENCE BOOK

1. Luzadder, Warren J., Duff, John M, "Fundamentals of Engineering", Prentice Hall of India,11th Edition, 2010, (ISBN: 978-81-203-0885-5)
2. Basudev Bhattacharya, "Machine Drawing includes Autocad Supplements", Oxford University Press India, First Edition, 2011, (ISBN 13: 9780198070771)
3. K. Venugopal, Prabhu Raja V., "Engineering Drawing and Graphics", New age Publications, First Edition, 2008, (ISBN: 978-81-224-2457-7)
4. N B Shaha and B C Rana, "Engineering Drawing", Pearson Education, 2012, (ISBN: 9788131798058)

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Logic Development- C Programming
	COURSE CODE	CS101
	COURSE CREDITS	3
RELEASE DATE : 01/07/2019	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME & MARKS						
		THEORY			PRACTICAL			TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	MSE	ESE	IA	
1	4	NIL	40	NIL	30	30	40	140

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CS101.CEO.1: Develop programming skills using the fundamentals and basics of C Language.

CS101.CEO.2: Enable effective usage of arrays, structures, functions, pointers and to implement the memory management concepts.

CS101.CEO.3: Teach the issues in file organization and the usage of file systems.

COURSE OUTCOMES:

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

CS101.CO.1: List the various data types, control structures and looping structures supported by C language.

CS101.CO.2: Differentiate between various data types supported by C language.

CS101.CO.3: Implement the solutions for various algorithms in C language.

CS101.CO.4: Analyze various parameter passing methods to functions in C language.

THEORY COURSE CONTENT		
UNIT 1	**Fundamentals of C Language**	**2 HOURS**
Overview of C, Character set, Constants, Variables and Keywords, Data types (Primitive and Derived), Operators (arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators) and Expressions (Type Conversion, precedence and order of evaluation), C Storage Classes, Managing Input and Output Operations, A structure of C Program, C Preprocessor, C Macro, Compilation, Execution, Debugging and Testing of C program.		
UNIT 2	**Control Structures**	**2 HOURS**
Decision Control Structure-If statement, if-else statement, Nested if-else statement, Ternary operator, Case Control structure- Switch Case Statements, GOTO statement, Loop Control Structure- while statement, do while statement, for statement, odd loop, nesting of loops, break and continue statement, finite & infinite Loop.		
UNIT 3	**Arrays and Functions**	**3 HOURS**
Arrays: Array Declaration and Initialization, Bounds Checking, Array arithmetic, One dimensional arrays and multi-dimensional Arrays, Strings - Standard Library String Functions, Array of strings. **Functions:** Function definition and prototype, Scope Rule of Functions, Calling Conventions, Passing Values between Functions - Call by Values and Call by References, Recursive functions, Passing Array Elements to a Function.		
UNIT 4	**Pointers**	**3 HOURS**
Pointers and Addresses, Pointer Notation & Arithmetic, Pointer to array, Array of pointers, Pointer to a function, Passing pointers as function arguments, Strings and Pointers, Structures and Pointers.		
UNIT 5	**User Defined Data Types**	**1 HOURS**
Structures & Union: Declaration of Structure and Union, Difference between Structure and Union, Accessing Structure Elements, How Structure Elements are Stored, Array of Structures.		
UNIT 6	**File Handling**	**2 HOURS**
File Operations-open, read, write, append, delete, Error Handling, File Opening Modes Using command line argument(argc and argv), line input and output operations, Miscellaneous Functions.		

PRACTICAL:		
PRACTICAL NO.01		**2 HOURS**
• Write a program in C to display "Hello World" • Write a menu driven program in C to display addition, subtraction, multiplication, division of two numbers		
PRACTICAL NO.02		**2 HOURS**
• Write a program in C to display the quotient and remainder after the division of two numbers • Write a menu driven program in C to demonstrate the use of left shift, right shift, and, or, xor operators		
PRACTICAL NO.03		**2 HOURS**
• Write a menu driven program in C to demonstrate the use of mathematical functions supported by math.h library • Write a program in C to display the grade obtained by the student in a course. The input will be the marks obtained and the output will be the grade obtained		
PRACTICAL NO.04		**2 HOURS**
• Write a program in C to display first N numbers on the screen using while, do while and for loop • Write a program in C to display first N number in reverse order on the screen using while, do while and for loop		
PRACTICAL NO.05		**2 HOURS**
Write a program in C display various patterns using *		
PRACTICAL NO.06		**2 HOURS**
• Write a program in C to display the addition of N numbers stored in an array • Write a program in C to copy the array of N numbers into another array in reverse order • Write a program in C to display the minimum and maximum element in an array		
PRACTICAL NO.07		**2 HOURS**
• Write a program in C to display the prime numbers within a given range • Write a program in C to display the fibonacci series within a given range		
PRACTICAL NO.08		**2 HOURS**
Write a menu driven program in C to perform addition, subtraction, division and transpose of matrices		

PRACTICAL NO.09		**2 HOURS**
• Write a program in C to convert every lowercase letter to uppercase letter and vice versa in a given string • Write a program in C to implement the string functions using the standard library functions supported by string.h like: string length, string copy, string reverse, string concatenate, string compare, sub string		
PRACTICAL NO.10		**2 HOURS**
• Write a program in C using functions to display addition, subtraction, multiplication, division of two numbers • Write a program in C using functions to display the minimum and maximum element in an array		
PRACTICAL NO.11		**2 HOURS**
Write a program in C using functions to implement the string functions without using the standard library functions supported by string.h like: string length, string copy, string reverse, string concatenate, string compare, string palindrome		
PRACTICAL NO.12		**2 HOURS**
• Write a program in C using functions and pointers to display addition, subtraction, multiplication, division of two numbers • Write a program in C using function and pointers to swap two numbers		
PRACTICAL NO.13		**2 HOURS**
Write a program in C using function and pointers to demonstrate the use of pointer arithmetic by taking input in an array		
PRACTICAL NO.14		**2 HOURS**
• Write a program in C using recursion to display the factorial of a number • Write a program in C using recursion to display fibonacci series within a given range		
PRACTICAL NO.15		**2 HOURS**
• Write a program in C to accept the information of single student and store it in structure and display the same • Write a program in C to accept the information of students and store it in array of structure and display the same		

PRACTICAL NO.16		**2 HOURS**
• Write a program in C to display Semester Grade Point Average (SGPA). Input will be stored in array of structure • Write a program in C to demonstrate the concept of union		
PRACTICAL NO.17		**2 HOURS**
Write a program in C to read a single line from the file using functions like fgetc, fgets, fscanf, and fread		
PRACTICAL NO.18		**2 HOURS**
Write a program in C to write a single string in a file using functions like fputc, fputs, fprintf and fwrite		
PRACTICAL NO.19		**2 HOURS**
Write a program in C to display contents of whole file on the screen		
PRACTICAL NO.20		**2 HOURS**
Write a program in C to read and write the record stored in structure from file		
PRACTICAL NO.21		**2 HOURS**
Write a program in C to implement student information system using array of structures		
PRACTICAL NO.22		**2 HOURS**
Write a program in C to implement Linear Search and Binary Search		
PRACTICAL NO.23		**2 HOURS**
Write a program in C to check whether a given matrix contains a saddle point		
PRACTICAL NO.24		**2 HOURS**
Write a program in C to implement union and intersection of two sets		

TEXT BOOK

1. E. Balguruswamy , "Programming in ANSI C" , Tata Mc-Graw Hill
2. Yashvant Kanitkar, "Let Us C" BPB Publication
3. "Programming With C", Schaum Series

REFERENCE BOOK

1. Kernighan and Ritchie , "The 'C' programming language" , Prentice Hall
2. V. Rajaraman , "Computer Programming in 'C' " , Prentice Hall
3. R.G. Dromey , "How to solve it by Computer", Pearson Education

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Experimental Tools and Techniques
	COURSE CODE	ME105
	COURSE CREDITS	2
RELEASE DATE : 01/07/2019	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
NIL	4	NIL	NIL	40	60	NIL	100

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

ME105.CEO.1: Introduce different tools and study various measurement techniques.
ME105.CEO.2: Study different parts of the system along with its functions and applications.
ME105.CEO.3: List various tools used for the said application.
ME105.CEO.4: Identify the function of various parts of the system.
ME105.CEO.5: Impart comprehensive knowledge for selection of appropriate techniques to the said application.
ME105.CEO.6: Apply the knowledge to find the solution for basic engineering problems.

COURSE OUTCOMES :

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

ME105.CO.1: Recall the tools required for the measurements.
ME105.CO.2: Summarize the application of various engineering tools used.
ME105.CO.3: Identify the right tools for selected purpose.
ME105.CO.4: Inspect various parts of the system.
ME105.CO.5: Justify the most appropriate technique which can be compatible with the existing environment.
ME105.CO.6: Develop the system which will give appropriate solution to the identified problem.

PRACTICAL:		
PRACTICAL NO.01	**Information Technology/Computer Engineering (Any 6 Practicals from the following list)**	**12 HOURS**

1. Study and analysis of various components on the motherboard of a standard desktop computer
2. Installation of various components like hard disk drive on the motherboard and check the system setup for verification
3. Formatting the hard disk drive and installation of Windows and Linux operating system making the system dual boot
4. Study of various network components like switch, Router and configure the devices.
5. Crimping of Unshielded Twisted Pair cable. (Cat-6)
6. Study of TCP/IP Stack, and configure as well as develop a Local Area Network.
7. Configuration of Network Monitoring tool and checking the results
8. Installation of DHCP server and checking the results.
9. Installation of web server and checking the results.
10. Configuration of MS Access and Deploying Access 2007 Runtime-Based Solutions.
11. Study and usage of Google Tools (creating Forms, Blog).
12. Using the Google form with add on, create a PDF file of the form.
13. Designing a static HTML page
14. Uploading the pages using FTP server on a web site
15. Deploy a simple web site using LAMP server
16. Creation of a web site using Google sites.

PRACTICAL NO.02	**Electronics Engineering (Any 06 practical's from the following list)**	**12 HOURS**

1. Study of basic electronics component and Switches.
2. PCB and Soldering Tools and Technique.
3. Relay and application.
4. Domestic wiring for Extension Board and Inverter.*
5. Load test of D.C. series motor.*
6. Brake test on D.C. Shunt motor.*
7. Load test on 3-phase induction motor.
8. V-I Characteristics of Thyristor & measurement of holding & latching current
9. V-I Characteristics of MOSFET.
10. V-I Characteristics of IGBT.
11. V-I Characteristics of TRIAC.
12. Solar cell and application (Generation of Energy).
13. Speed control of DC Motor (Toy Motor)
14. Actuators and application (Electrical and Mechanical).

15 Study of Virtual Instrumentation.

16 Open IT : Optical Mouse, Cathode Ray Oscilloscope, Study of Power Supply PA System, CD Player, TV, Microwave oven (Any Two)

PRACTICAL NO.03	**Mechanical Engineering (Any 6 practicals from the following list)**	**12 HOURS**

1. Linear and angular measurements.
2. Measurement of transmission ratio in Belt drive, Chain drive, and Gear drive.
3. Measurement of RPM of rotating machine using contact and non-contact type tachometer.
4. Types of mechanism and making any one mechanism containing four links using cardboard.
5. Measurement of Barometric pressure, introduction to pressure measuring devices like bourdon tube pressure gauge and manometer. Fabrication of simple type manometer.
6. Introduction to temperature measuring devices. Making and calibration of thermo couple and using it with temperature indicator.
7. Measurement of Relative humidity of air in the lab.
8. Measurement of hardness of Steel and Aluminum.
9. Measurement of stiffness of helical spring (compression or tension)
10. Servicing of 2 wheeler and 4 wheeler system.
11. Study of various components of automobile system.
12. Open IT: Mixer or kitchen machine, Refrigerator, Boiler and accessories thermal power plant (Mini), Two stroke and four stroke engine, Introduction to threaded fasteners and joints using threaded fasteners. Bearing and its lubrication, Bicycle /Two wheeler/ 4 wheeler(Any Two)

PRACTICAL NO.04	**Chemical Engineering (Any 3 practicals from the following)**	**6 HOURS**

1. Determination of specific gravity of liquid
2. Study of molecular diffusion
3. Liquid –liquid extraction: Separation of one liquid component from the solution.
4. Solid-liquid separation from filtration
5. Membrane Separation process
6. Fuel from Plastic
7. Demonstration of mechanical operation models.
8. Plate type heat exchanger
9. Water purifier (Household)

PRACTICAL NO.05	Civil Engineering (Any 3 Practicals from the following)	6 HOURS

1. To find the area and included angle of given plot and fix boundary from given plan.
2. To determine the level difference between 5 points with level tube and determine height of tower with trigonometry.
3. To draw the plan of given parcel of land to a given scale.
4. To draw line diagram of household water supply line and sewage line with list of materials used.
5. To draw line diagram of rain water harvesting unit with all details and its importance.
6. To make report on daily water requirement in public building and its waste water disposal, and reuse.
7. To identify and make report on the earthquake resisting structural members of building and its role.
8. To demonstrate the life saving do s and don'ts during the different natural calamities.
9. To demonstrate the dos and donts after different natural calamities.

Assessment	Common to all branches	4 HOURS

TEXT BOOK

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

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.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Statistics and Integral Calculus
	COURSE CODE	AS107
	COURSE CREDITS	4
RELEASE DATE : 01/07/2019	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		**EXAMINATION SCHEME AND MARKS**					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	TUTORIAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	1	20	40	40	50	NIL	150

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

AS107.CEO.1: Study different statistical methods for solving problems.
AS107.CEO.2: Analyze different probability distribution functions.
AS107.CEO.3: Extend the basic concepts of integration for evaluation of complex integration problems.
AS107.CEO.4: Categorize and use equation of curves to trace the given curve.
AS107.CEO.5: Demonstrate an understanding towards evaluating multiple integrals.
AS107.CEO.6: Relate and examine the applications of multiple integrals.

COURSE OUTCOMES:

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

AS107.CO.1: Assess statistical problems.
AS107.CO.2: Solve the probability distribution problems.
AS107.CO.3: Evaluate complex integrals.
AS107.CO.4: Sketch curves by analyzing the given equation of curves.
AS107.CO.5: Evaluate the multiple integrals.
AS107.CO.6: Apply the knowledge of multiple integrals to solve engineering problems.

THEORY COURSE CONTENT		
UNIT 1	**Statistics**	**6 HOURS**
Measures of central tendency, standard deviation, coefficient of variation, moments, skewness and kurtosis, correlation(Karl Pearson's coefficient of correlation) and regression		
UNIT 2	**Probability**	**6 HOURS**
Probability, probability density function, probability distribution: Binomial, Poisson, Normal		
UNIT 3	**Integral Calculus**	**7 HOURS**
Reduction formulae, Gamma function, Beta function, Differentiation under integral sign.		
UNIT 4	**Curve Tracing and Rectification**	**7 HOURS**
Tracing of Curves: Cartesian curves, Parametric curves, Polar curves. Rectification: Rectification of Cartesian, Parametric and Polar curves		
UNIT 5	**Multiple Integrals**	**7 HOURS**
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		
UNIT 6	**Applications of Multiple Integrals**	**6 HOURS**
Applications of multiple integrals to find Area, Volume, Centre of Gravity, and Moment of Inertia		

TUTORIAL: Problem solving session		
TUTORIAL NO.01		**1 HOURS**
Measures of central tendency, standard deviation, coefficient of variation		
TUTORIAL NO.02		**1 HOURS**
Moments, skewness and kurtosis		
TUTORIAL NO.03		**1 HOURS**
Correlation and regression		
TUTORIAL NO.04		**1 HOURS**
Probability, probability density function, Probability distribution: Binomial		
TUTORIAL NO.05		**1 HOURS**
Probability distribution: Poisson, Normal. Reduction formulae, Gamma function		
TUTORIAL NO.06		**1 HOURS**
Beta function, DUIS Rule1 & 2.		

TUTORIAL NO.07		**1 HOURS**
Tracing of Cartesian, Polar and Parametric curves.		
TUTORIAL NO.08		**1 HOURS**
Rectification of Cartesian, Polar and Parametric curves.		
TUTORIAL NO.09		**1 HOURS**
Double Integration, Evaluation of Double Integration, Change the order of integration, Integration by transforming Cartesian to Polar Coordinate system		
TUTORIAL NO.10		**1 HOURS**
Triple integration, Integration by transforming to spherical and cylindrical polar coordinates. Applications of multiple integrals: To find Area, Volume		
TUTORIAL NO.11		**1 HOURS**
Applications of multiple integrals: To find Centre of Gravity of an arc, plane lamina and a solid.		
TUTORIAL NO.12		**1 HOURS**
Applications of multiple integrals: To find Moment of Inertia about an arc, plane and solid		

TEXT BOOK

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10 th edition, Wiley Eastern Ltd, 2015, ISBN: 9788126554232, 8126554231,
2. B.S. Grewal ,Higher Engineering Mathematics ,39th edition, Khanna Publications,2005 , ISBN: 81-7409- 195-5

REFERENCE BOOK

1. G.B. Thomas & R.L.Finney, Calculus, 9th edition, Pearson Education, 2002, ISBN: 81-7758-325-5.
2. Dr. B.V. Ramana ,Higher Engineering Mathematics,4 th edition, Tata McGraw Hill,2016, ISBN: 978-0-07-063419-
3. R.K. Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing house,2002,ISBN No.0849324173
4. Peter V. O'Neil , Advanced Engineering Mathematics,7th Edition , Cenage Learning ,2012, ISBN-13: 9788131503102.
5. Dennis G. Zill & Warren S. Wright ,Advanced Engineering Mathematics ,4th edition ,Jones and Bartlett Publishers, 2011, ISBN-10: 0-7637-7966-0, ISBN – 13: 978-0-7637-7966-5.
6. Douglas C. montgomery , George C runger ,Applied statistics and probability for engineers, 5 th edition, wiley ,2012, ISBN No: 9788126537198, 8126537191 .
7. Richard A Johnson, Irwin Miller,John freund ,Miller & Freund's Probability and statistics for engineers 8th edition, Pearson, 2011,ISBN no:978-93325-5041-4.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Science of Nature
	COURSE CODE	CH101
	COURSE CREDITS	4
RELEASE DATE : 01/07/2019	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	20	40	40	50	NIL	150

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH101.CEO.1: Make students conversant with basic Biology regarding the life processes.

CH101.CEO.2: Study biology and engineering as biologically inspired technologies like designs in nature, bioenergetics, bioprocesses, biomaterials, biomechanics, bioinstrumentation.

CH101.CEO.3: Outline the technology involved in improving quality of water for its industrial use.

CH101.CEO.4: Illustrate the basic principles, instrumentation & applications of analytical techniques.

CH101.CEO.5: Get familiarize with the new concepts of Nano Science and Technology.

CH101.CEO.6: Define the basic aspects and applications of polymers, biomaterials & composites.

COURSE OUTCOMES :

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

CH101.CO.1: Explain natural biological processes and their technical aspects in view of optimizing Engineering solutions.

CH101.CO.2: Explain important biological inventions that changed the human life and their impact on engineering.

CH101.CO.3: Identify different methodologies for water quality analysis for industrial application.

CH101.CO.4: Apply basic concepts of analytical techniques for analysis of various chemical compounds.

CH101.CO.5: Apply the knowledge of nano science for betterment of the society.

CH101.CO.6: Categorize the different engineering materials and to solve engineering problems.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Science of Nature**	**7 HOURS**
The basics of science of nature. Exploring science in nature, specially symmetry, spiral, golden ratio, pattern and fractal. The phenomenon observed in nature viz., Physical, Chemical and Biological. Case studies and Applications. The diversity and commonality of cells, protein structure and function, basic molecular genetic mechanisms, bio membranes and cell architecture, transport of ions and small molecules across Cell membranes, cellular energetics, cell birth, lineage and death.		
UNIT 2	**Applications of Biology**	**6 HOURS**
Physiologic Systems - An Outline of Cardiovascular Structure and Function, Endocrine System, Nervous System, Vision System, Defense mechanisms in plants and animals. Introduction to Bio Sensors, Performance Factors, Factors Affecting the Performance of Sensors, Areas of Application. Biological Sensing Elements, Biological transducers. Discovery and Innovations in applications of Biology.		
UNIT 3	**The Role of Chemistry for Engineers**	**7 HOURS**
(A) **Introduction:** This section is an introduction to chemistry and chemical methods for engineering students. It describes how chemistry is used in engineering and how chemical principles aid engineers in the choice of materials for a particular application. Principles of Green chemistry are reviewed. The classification of separation methods used for mixtures. (B) **Periodic Table:** This section covers the names and symbols of the elements. The basic structure of the atom is reviewed including an explanation of isotopes. A discussion of the atomic structure describes electronic shells, subshells, their quantum numbers, orbital shapes, electron filling order, and the determination of the complete electron configuration of the elements. General description of the modern periodic table. Correlation between the valence electron configurations and the chemical properties of the elements. The periodic trends according to the position of the elements in the periodic table.		
UNIT 4	**Chemical Bonding - The Formation of Materials**	**8 HOURS**
(A) **The Formation of Materials:** This section covers chemical bonding and its effect on the chemical properties of the elements. Ionic bonding & covalent bonding are compared in terms of the octet rule and valence bond theory. Polar and non-polar covalent bonds. Molecular orbital theory is introduced to explain magnetism, bond order and hybridization helpful in Carbon chemistry. Intermolecular forces, including hydrogen bonding, are discussed with a special Case Study focusing on the special properties of water. (B) **Engineering Materials:** This section covers the Resources of Natural Materials, Introduction to Material Sciences viz. Polymers, Specialty polymers, Biomaterials, Nano materials and Smart materials with their examples and applications.		
UNIT 5	**Chemical Analysis and Instrumentation**	**6 HOURS**
Schrodinger's 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 Bohr's atomic model.		

UNIT 6	Water Treatment and Effluent Management	5 HOURS
This chapter covers types of impurities in water & the conventional water treatment methods. Hardness, Alkalinity and Chloride content of water, its causes, types and volumetric methods for their determinations are reviewed along with numerical. Various water softening & treatment methods which includes filtration methods by Carbon adsorption, ion-exchange methods and membrane techniques are explained		

PRACTICAL: Any 8 Experiments		
PRACTICAL NO.01	**Distillation**	**2 HOURS**
Separation of two miscible liquids using distillation process		
PRACTICAL NO.02	**Polymerization**	**2 HOURS**
Synthesis by condensation polymerization reaction		
PRACTICAL NO.03	**Nano Particle**	**2 HOURS**
Synthesis of nano particles using reduction method		
PRACTICAL NO.04	**pH Metry**	**2 HOURS**
Determination of the dissociation constant of a weak acid using pH meter		
PRACTICAL NO.05	**Paper Chromatography**	**2 HOURS**
Separation of inorganic cations by paper chromatography		
PRACTICAL NO.06	**TLC**	**2 HOURS**
Separation of organic compounds by TLC		
PRACTICAL NO.07	**Conductometry**	**2 HOURS**
Conductometric titration for mixture of acids.		
PRACTICAL NO.08	**Colorimetry / Spectrophotometry**	**2 HOURS**
Absorption studies		
PRACTICAL NO.09	**Hardness of Water**	**2 HOURS**
Determination of Hardness of water by EDTA method		
PRACTICAL NO.10	**Alkalinity**	**2 HOURS**
Determination of alkalinity of water by neutralization titration		
PRACTICAL NO.11	**Adsorption Studies**	**2 HOURS**
Water purification by activated charcoal		

PRACTICAL NO.12	Physical Phenomenon	2 HOURS
Case Studies of Physical Phenomenon		
PRACTICAL NO.13	**Chemical Phenomenon**	**2 HOURS**
Case Studies of Chemical Phenomenon		
PRACTICAL NO.14	**Biological Phenomenon**	**2 HOURS**
Case Studies of Biological Phenomenon		

TEXT BOOK

1. Jain & Jain, "Engineering Chemistry", 16th Edition, Dhanpat Rai Publications company,2015, ISBN: 978-93-5216-000-6
2. S.M. Khopkar , "Basic Concept of Analytical Chemistry",3rd edition, New Age International (P) Ltd., 2008, ISBN-10: 81-224-2092-3; ISBN-13: 978- 81-224-2092-0
3. Dr. B. S. Chauhan , "Engineering Chemistry", 3rd Edition, University Science Press (Laxmi Publications Pvt. Ltd).,2009, ISBN: 978-81-318-0579-4.
4. Lodish H, Berk A, Zipursky SL, et al., "Molecular Cell Biology", 5th Ed., W. H. Freeman publications, 2000.
5. Palsson B.O. and Bhatia S.N., "Tissue Engineering", Pearson, 2009,
6. Brian R. Eggins, "CHEMICAL SENSORS AND BIOSENSORS", JOHN WILEY & SONS, LTD, 2004.

REFERENCE BOOK

1. Jeffrey S. Gaffney and Nancy A. Marley General Chemistry for Engineers, Elsevier, 2018, ISBN: 978- 0-12-810425-5
2. Skoog, West, Holler, Crouch, "Fundamentals of Analytical Chemistry", 8th Edition Cengage Learning, 2009, ISBN-13: 978—81-315-0051-4, ISBN-10: 81-315-0051-9
3. Willard, Merritt, Dean and Settle, "Instrumental Methods of analysis (Chemistry)", 6th edition, Wadsworth Publishing Co., 1988, 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, ISBN: 0495668028.
5. O. G. Palanna, "Engineering Chemistry", 1st Edition, Tata McGraw Hill education Pvt. Ltd., 2009, ISBN-13: 978-0-07-014610-5, ISBN (10): 0-07-014610-1.
6. Pradeep T., "A Text Book of Nanoscience and Nanotechnology", Tata McGraw Hill, New Delhi, 2012.
7. Reece, J. B., Taylor, M. R., Simon, E. J. and Dickey, J. L. (2013) Campbell Biology: Concepts and Connections (Seventh Edition) (Pearson) ISBN 1292026359

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Applied Mechanics
	COURSE CODE	CV102
	COURSE CREDITS	4
RELEASE DATE : 01/07/2019	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	20	40	40	25	25	150

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CV102.CEO.1: Classify force systems and explain the conditions of equilibrium.
CV102.CEO.2: Illustrate laws of friction.
CV102.CEO.3: Demonstrate the concepts of Centroid and moment of inertia.
CV102.CEO.4: Describe kinematic parameters of motion.
CV102.CEO.5: Make use of laws of motion for kinetics.
CV102.CEO.6: Explain energy and momentum methods.

COURSE OUTCOMES:

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

CV102.CO.1: Determine the resultant and support reactions.
CV102.CO.2: Equilibrium Analysis of bodies involving frictional forces.
CV102.CO.3: Evaluate Centroid of bodies and moment of inertia of sections.
CV102.CO.4: Identify the type of motion and its kinematic parameters.
CV102.CO.5: Analyze the motion under action of constant and variable forces.
CV102.CO.6: Apply energy and momentum methods for kinetics problems.

THEORY COURSE CONTENT		
UNIT 1	**Fundamentals of Statics**	**8 HOURS**
Basic concepts in mechanics, Fundamental principles/laws of mechanics, Force, moment of a force and couple, Resolution and composition of forces, Resultant of coplanar forces, Free body diagrams, Equilibrium of coplanar forces, Applications to simple beams and cables. **Further Reading:** *Self study-Application to jib crane.		
UNIT 2	**Friction**	**6 HOURS**
Introduction to friction, Types of friction, Laws of friction- coefficient of friction, Theory of friction- angle of friction, angle of repose, cone of friction, Engineering applications - Block and wedge friction, ladder friction, Belt Friction. **Further Reading:** *Self study-Screw friction.		
UNIT 3	**Properties of Surfaces**	**6 HOURS**
Concept of Centroid and centre of gravity. Centroid of standard objects, Centroid of composite 1D and 2D objects, Concept of area moment of inertia, Radius of gyration and its significance, Parallel and perpendicular axis theorems, Moment of inertia of standard and composite 2D figures. **Further Reading:** *Self study- Mass moment of Inertia.		
UNIT 4	**Kinematics of Planar Motions**	**7 HOURS**
Basic concepts in kinematics, Rectilinear motion with uniform and variable acceleration, Motion under Gravity, Motion curves, Curvilinear Motion in Rectangular and path coordinates, Projectile motion. **Further Reading:** *Self study- Curvilinear motion in polar coordinates.		
UNIT 5	**Kinetics- Force and Acceleration**	**6 HOURS**
Newton's second laws of Motion, Free body diagram equation- Rectilinear motion, Concept of dynamic equilibrium. Motion of connected bodies, Equations of motion in rectangular and path coordinates for curvilinear motion. **Further Reading:** *Self study- Free Vibrations.		
UNIT 6	**Kinetics Energy and Momentum**	**6 HOURS**
Concepts of Work, power and energy, Work done by gravity, spring and frictional forces, Principle of work and Energy, Conservation of mechanical energy, Concept of Impulse and linear momentum, Impulse-momentum theorem, Conservation of linear momentum, Collisions- Types of collisions, Coefficient of restitution, Applications to vehicles and sports. **Further Reading:** *Self study- Space mechanics.		

PRACTICAL: Any 8 Experiments		
PRACTICAL NO.01	**Basic Principles/Laws**	**2 HOURS**
To verify basic laws of mechanics.		
ACTIVITY NO.01	**Exploring Scientific Calculator**	**2 HOURS**
To complete the given task of calculations in a stipulated time with desired accuracy using a scientific calculator.		
PRACTICAL NO.02	**Friction**	**2 HOURS**
To determine coefficient of friction for a given surfaces		
ACTIVITY NO.02	**Presentations**	**2 HOURS**
To prepare and deliver a PPT presentation on engineering application of friction.		
PRACTICAL NO.03	**Centroid**	**2 HOURS**
To determine Centroid of a given 1D object		
ACTIVITY NO.03	**Act of Balancing**	**2 HOURS**
To cut a 2D figure precisely and locate a balancing point on it.		
PRACTICAL NO.04	**Motions**	**2 HOURS**
To study and analyze a given set of motion.		
ACTIVITY NO.04	**Graphing the Motion**	**2 HOURS**
To draw x-t, v-t, a-t graphs for given description of motion in stipulated time.		
PROJECT		**10 HOURS**
To fabricate a model of simple structure or mechanism from low cost materials.		

TEXT BOOK

1. A. Nelson "Engineering Mechanics: Statics and Dynamics", 1st edition ,Tata McGraw-Hill Education, 2009, ISBN: 978-0-07-014614-3
2. R.C Hibbeler "Engineering Mechanics: Statics and Dynamics ",12th edition, Pearson Education, 2010, ISBN: 978-0136077909

REFERENCE BOOK

1. F. P. Beer and E. R. Johnston "Vector Mechanics for Engineers Vol.I and II",10th edition, Tata Mc-Graw-Hill Education, 2012, ISBN: 978-0077402327
2. Ferdinand Singer, "Engineering Mechanics Statics and Dynamics", 3rd edition Harper and Row, 1994 ISBN:0063506610
3. Manoj K Harbola "Engineering Mechanics",1st edition, Cengage Learning, 2009, ISBN:8131509907

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Applications Programming-Python
	COURSE CODE	CS102
	COURSE CREDITS	3
RELEASE DATE : 01/07/2019	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME & MARKS						
		THEORY			PRACTICAL			TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	MSE	ESE	IA	
1	4	NIL	40	NIL	30	30	40	140

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CS102.CEO.1: Get familiar with basics of Python programming.
CS102.CEO.2: Understand usage of conditional and looping statements in Python.
CS102.CEO.3: Learn different simple data structure supported in Python.
CS102.CEO.4: Acquire knowledge and skills of strings and dictionary.
CS102.CEO.5: Implement Object Oriented Programming concepts using Python.
CS102.CEO.6: Introduce the concepts of Pandas & NumPy.

COURSE OUTCOMES :

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

CS102.CO.1: Debug syntax and semantics in Python programs.
CS102.CO.2: Demonstrate proficiency in handling strings and file system.
CS102.CO.3: Implement the programs using core data structures like Lists and Dictionaries.
CS102.CO.4: Interpret the concepts of Object Oriented Programming in Python
CS102.CO.5: Develop solution for real life problems using Python.

THEORY COURSE CONTENT		
UNIT 1	**Python Fundamentals and Data Handling**	**2 HOURS**
Introduction, Features of Python, History and Future of Python, Writing and executing Python program, Literal constants, variables and identifiers, Data Types ,Mutable and immutable types, Input output operation , Comments, Reserved words, Indentation, Operators and expressions.		
UNIT 2	**Decision and Iterative Statements**	**2 HOURS**
Introduction to Decision Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if, if-elif-else statements. **Introduction to Iterative Statements:** Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops, break, continue, pass, else statement used with loops.		
UNIT 3	**List manipulation, Tuples and Python Function**	**2 HOURS**
List: Introduction, creating & accessing lists, list operations, working with lists, list functions & methods. **Tuples:** Introduction, creating & accessing tuples, tuples operations, tuples functions & methods. **Functions:** Need for functions, definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function, documentation string, good programming practices. Introduction to modules, Introduction to packages in Python, Introduction to standard library modules.		
UNIT 4	**Strings and Dictionary**	**3 HOURS**
Strings: Introduction, string operations- concatenation, appending, multiplication and slicing. Strings are immutable, strings formatting operator, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings, Iterating strings, the string module. **Dictionary:** Introduction, working with dictionaries, dictionary functions and methods		
UNIT 5	**Object Oriented Programming**	**2 HOURS**
Programming Paradigms-monolithic, procedural, structured and object oriented, Features of Object oriented programming-classes, objects, methods and message passing, inheritance, polymorphism, containership, reusability, delegation, data abstraction and encapsulation. Classes and Objects: classes and objects, class method and self-object, class variables and object variables, public and private members, class methods		
UNIT 6	**Data Structure and Libraries in Python**	**2 HOURS**
Introduction to data structure, pandas, NumPy.		

PRACTICAL:		
PRACTICAL NO.01		**2 HOURS**
To accept an object mass in kilograms and velocity in meters per second and display its momentum. Momentum is calculated as e=mc2 where m is the mass of the object and c is its velocity.		
PRACTICAL NO.02		**2 HOURS**
Write a Python program for following conditions. • If n is single digit print square of it. • If n is two digit print square root of it. • If n is three digit print cube root of it.		
PRACTICAL NO.03		**4 HOURS**
Solve the Fibonacci sequence using recursive function in Python.		
PRACTICAL NO.04		**4 HOURS**
Write a Python program to print different patterns.		
PRACTICAL NO.05		**2 HOURS**
To accept student's five courses marks and compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course. If student scores aggregate greater than 75%, then the grade is distinction. If aggregate is 60>= and <75 then the grade if first division. If aggregate is 50>= and <60, then the grade is second division. If aggregate is 40>= and <50, then the grade is third division.		
PRACTICAL NO.06		**4 HOURS**
To check whether input number is Armstrong number or not. An Armstrong number is an integer with three digits such that the sum of the cubes of its digits is equal to the number itself. Ex. 371.		
PRACTICAL NO.07		**2 HOURS**
Write a program in Python to enter two unequal nos. if first no. is greater than display square of the smaller no. and cube of the greater no. otherwise vice-versa. If no. are equal display the message both no. are equal find square, square root and cube root of a number.		
PRACTICAL NO.08		**4 HOURS**
Write a Python program to perform following string operations. a) String concatenation b) String Reverse c) String compare d) String length e) Palindrome f) Case change.		
PRACTICAL NO.09		**2 HOURS**
Select the number from the entered list and find its position in Python (use Linear Search).		
PRACTICAL NO.10		**4 HOURS**
Choose cricket team of eleven players find the captain of the team (consider tallest person as a captain) using dictionary.		

PRACTICAL NO.11		6 HOURS

1. Write Python class for bank customer with withdraw and deposit operations (use inheritance) (Introduce class, object concepts).
2. Using concepts of polymorphism write Python application program.

Write a Python program to perform addition and multiplication of 2 matrices.

PRACTICAL NO.12		4 HOURS

Write a Python program to convert a Panda module Series to Python list and it's type.

PRACTICAL NO.13		4 HOURS

Write a NumPy program for Plotting and analyzing data.

Mini Project:

1. Project is for a period of 2 weeks.
2. Group of two or three has to choose project topic from the list designed by concerned faculty of particular division.
3. Each group has to collect requirements for project and get approved by concerned teachers in first weeks.
4. implementation and testing need to be performed in second week.
5. Demonstration along with presentation need to be given as final project submission.
6. Project carries 20 Marks.

TEXT BOOK

1. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Create Space Independent Publishing Platform, 2016. (http://do1.drchuck.com/pythonlearn/EN_us/pythonlearn.pdf) (Chapters 1 – 13, 15)
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2ndEdition, Green Tea Press, 2015. http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Chapters 15, 16, 17) (Download pdf files from the above links)

REFERENCE BOOK

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
2. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python", 1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978- 8126562176.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	German Language
	COURSE CODE	HP104
	COURSE CREDITS	2
RELEASE DATE : 01/07/2019	**REVISION NO**	0.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

HP104.CEO.1: To introduce German as a foreign language and enhance knowledge, communication and intellectual capabilities which helps to improve cognitive skills and creativity vital for problem solving and innovation.

HP104.CEO.2: To develop an awareness of German culture along with providing better career opportunities later in life.

COURSE OUTCOMES:

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

HP104.CO.1: Participant will study the foundational aspects of grammar, develop comprehension of low to medium difficulty text and practice speaking about every day basic topics

HP104.CO.2: Develop basic communication and comprehension skills for conducting day-to-day business effectively

HP104.CO.3: Use simple, familiar expressions to interact with native speakers or when visiting Germany

HP104.CO.4: Enhance their knowledge of German culture and society

THEORY COURSE CONTENT		
UNIT 1		**2 HOURS**
Introduction- Alphabets, Numbers 0-20, Self Introduction and Introducing third person. Grammar- wh Questions(w-frage), pronouns.		
UNIT 2		**4 HOURS**
Greetings, Speaking about different Languages and Countries, numbers above 20, seasons Grammar- Yes or no Questions, Sentence Construction verbs and conjugations of regular verbs		
UNIT 3		**4 HOURS**
Speaking about hobbies and interests, different professions, weekdays, months Grammar- Nouns, Articles, conjugations of irregular verbs		
UNIT 4		**6 HOURS**
Vocabulary related to food, different places in the city, transport Grammar- Imperative sentence		
UNIT 5		**4 HOURS**
Relations, understanding clock timings Grammar- Cases, Nominative case, nominative verbs pronouns and articles		
UNIT 6		**6 HOURS**
Body parts, directions, asking for the address email address and telephone number Grammar- Accusative case, accusative verbs pronouns and articles		

TEXT BOOK

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

REFERENCE BOOK

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Japanese Language
	COURSE CODE	HP105
	COURSE CREDITS	2
RELEASE DATE : 01/07/2019	**REVISION NO**	0.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

HP105.CEO.1: To perform daily basic activities including below mentioned.
HP105.CEO.2: Self Introduction, Greetings in Japanese.
HP105.CEO.3: Introduction to Japanese scripts- Hiragana, Katakana, Kanji.
HP105.CEO.4: Develop basic vocabulary throughgroup activities, videos.
HP105.CEO.5: Develop an understanding business etiquette.
HP105.CEO.6: Introduce topics related daily conversation, listening skills, cultural awareness.

COURSE OUTCOMES:

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

HP105.CO.1: Participant will study the foundational aspects of grammar, develop comprehension of low to medium difficulty text and practice speaking about every day basic topics.
HP105.CO.2: Develop basic communication and comprehension skills for conducting day-to-day business effectively.
HP105.CO.3: Use simple, familiar expressions to interact with native speakers or when visiting Japan.
HP105.CO.4: Enhance their knowledge of Japanese culture and society.

THEORY COURSE CONTENT		
UNIT 1		**4 HOURS**
How to give self-Introduction in Japanese, Greetings in Japanese.		
UNIT 2	**Hiragana, vocabulary and listening.**	**4 HOURS**
How to give self-Introduction in Japanese, Greetings in Japanese.		
UNIT 3		**4 HOURS**
Hiragana and Katakana, and Japanese games.		
UNIT 4		**4 HOURS**
Family Members understanding in Japanese. and Vocab.		
UNIT 5		**5 HOURS**
Japanese cultures study, and business etiquette.		
UNIT 6		**5 HOURS**
Daily conversation and cultural study.		

TEXT BOOK

1. Minna Na Nihongo, Goyal Publications.

REFERENCE BOOK

1. Nil

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Design Thinking
	COURSE CODE	ME106
	COURSE CREDITS	2
RELEASE DATE : 01/07/2019	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
NIL	4	NIL	NIL	40	NIL	60	100

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

ME106.CEO.1: Disseminate the philosophy of design thinking.
ME106.CEO.2: Impart the information regarding User centric approach.
ME106.CEO.3: Give exposure to information collection tools to clearly define user centric problem.
ME106.CEO.4: Enhance thinking in order to inspect diverse solutions.
ME106.CEO.5: Sensitize about the feasibility, desirability and viability criteria's for selection of Appropriate solution.
ME106.CEO.6: Educate about different types of prototyping.

COURSE OUTCOMES:

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

ME106.CO.1: Recall fundamental principles of design thinking.
ME106.CO.2: Explain all the dimensions of user and his needs using design thinking approach.
ME106.CO.3: Outline user centric problem by using information gathering techniques.
ME106.CO.4: Compare multiple solutions through ideation process.
ME106.CO.5: Interpret most appropriate solution for defined user centric problem.
ME106.CO.6: Develop the most optimum solution.

PRACTICAL:		
PRACTICAL NO.01	**Human Centred Design**	**2 HOURS**
Introduction to Human Centred Design, Human Centred Design Phases, Human Centred Design Process, Human Centred Design case study		
PRACTICAL NO.02	**Research Methodology (Problem Definition, Information Gathering)**	**4 HOURS**
Design thinking Models & Methodology - General Problem Statement, Random check list, mind mapping Categorization of random check list. Brainstorming of problem areas, Research Methodology - Information gathering - Primary, Secondary Sources, data presentation, Preparation of survey forms, Survey Analysis, Drawing Inference.		
PRACTICAL NO.03	**Ideation**	**4 HOURS**
SWOT analysis, Vein Diagram (User Desirability, Feasibility, Viability check) Drawing inferences, Translation of inferences into design criteria, specific problem statement, Ideation – free hand sketching drawing of simple form of products (Isometric views, layout, circuit diagram, Ideation sketches), Ergonomic and aesthetic consideration in design.		
PRACTICAL NO.04	**Prototyping**	**2 HOURS**
Concept validation, evaluation and detailing, Different methods of Prototyping, selection of right method of prototyping.		
PROJECT		**40 HOURS**
PRACTICAL NO.05	**Phase 1 : General Problem Statement and problem background**	**4 HOURS**
PRACTICAL NO.06	**Phase 2 : Research methodology**	**4 HOURS**
PRACTICAL NO.07	**Phase 3 : Product Specification**	**4 HOURS**
PRACTICAL NO.08	**Phase 4 : Ideation**	**6 HOURS**
PRACTICAL NO.09	**Phase 5 : Concept Evaluation, Validation and Concept detailing**	**8 HOURS**
PRACTICAL NO.10	**Phase 6 : Prototyping**	**10 HOURS**
PRACTICAL NO.11	**Phase 7 : Documentation**	**4 HOURS**

TEXT BOOK

1. Emrah Yayici, Design Thinking Methodology Book, Amazon Digital Services LLC - Kdp Print Us, 2016, ISBN: 6058603757, 9786058603752
2. Idris Mootee, Design Thinking for Strategic Innovation, Wiley (2017), ISBN-13: 978-8126572694
3. Thomas Lockwood, Design Thinking: Integrating Innovation, Customer Experience, and Brand Value, Allworth Press; Original edition (10 November 2009), ISBN-13: 978-1581156683

REFERENCE BOOK

1. Harper Perennial, Lateral Thinking: Creativity Step by Step; Reissue edition, 2015 (Perennial Library).
2. John Chris Jones, Design Methods, John Wiley & Sons, David Fulton Publishers, London, 1980, ISBN 0-471-28496-3.
3. Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers (May 15, 2011), ISBN-13: 978-1847886361
4. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, Published September 29th 2009 by Harper Business, ISBN 0061766089

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2019 - 2020 (Rev. 2019)
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Indian Constitution (Audit Course)
	COURSE CODE	HP106
	COURSE CREDITS	NIL
RELEASE DATE : 01/07/2019	**REVISION NO**	0.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

HP106.CEO.1: To realise the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.

HP106.CEO.2: To identify the importance of fundamental rights as well as fundamental duties.

HP106.CEO.3: To understand the functioning of Union, State and Local Governments in Indian federal system

HP106.CEO.4: To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure

COURSE OUTCOMES:

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

HP106.CO.1: Understand and explain the significance of Indian Constitution as the fundamental law of the land.

HP106.CO.2: Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.

HP106.CO.3: Analyze the Indian political system, the powers and functions of the Union, State and Local Governments in detail.

HP106.CO.4: Understand Electoral Process, Emergency provisions and Amendment procedure.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Indian Constitution**	**2 HOURS**
Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India, Salient features and characteristics of the Constitution of India, Scheme of the fundamental rights, The scheme of the Fundamental Duties and its legal status, The Directive Principles of State Policy – Its importance and implementation.		
UNIT 2	**Federal Structure and Amendment**	**4 HOURS**
Federal structure and distribution of legislative and financial powers, between the Union and the States, Parliamentary Form of Government in India – The constitution powers and status of the President of India, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India.		
UNIT 3	**Emergency Provisions**	**2 HOURS**
Emergency Provisions: National Emergency, President Rule, Financial Emergency.		
UNIT 4	**Constitutional Schemes**	**4 HOURS**
Local Self Government – Constitutional Scheme in India, 13. Scheme of the Fundamental Right to Equality, Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and Personal Liberty under Article 21.		

TEXT BOOK

1. D. D. Basu, Introduction to the Constitution of India, LexisNexis.
2. Granville Austin, The Constitution of India: Cornerstone of a Nation, Oxford University Press.

REFERENCE BOOK

1. Subhash Kashyap, Our Constitution, National Book Trust.
2. M.P. Jain, Indian Constitutional Law, LexisNexis.
3. V .N.Slmkla , Constitution of lndia , Ea stern Book Co mpany.
4. P.M. Bak shi , The Constitution of India , Universal Law Publishing.
5. M.V.Pylee, Constitutional Government in India , S. Chand.
6. V. S. Khare, Dr. B.R. Ambedkar and India ' s National Security.

MIT | Academy of Engineering

MIT ACADEMY OF ENGINEERING, ALANDI

An Autonomous Institute Affiliated to

Savitribai Phule Pune University

Curriculum

For

Second Year

Bachelor of Technology in Chemical Engineering

2019-2023

(With Effect from Academic Year: 2020-2021)

MIT | Academy of Engineering Autonomous Institute Affiliated to SPPU	COURSE STRUCTURE (2019 - 2023)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2020-2021
SECOND YEAR BACHLEOR OF TECHNOLOGY IN CHEMICAL ENGINEERING	RELEASE DATE	:	01/07/2020
	REVISION NO.	:	1.0

SEMESTER: III												
INTERNSHIP (CH200)												
COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
ESC6	ME221	Material Engineering	3	2	-	35	35	30	0	50	150	4
DC01	CH221	Material and Energy Balance	3	0	-	35	35	30	0	0	100	3
DC02	CH222	Inorganic and Analytical Chemistry	3	2	-	35	35	30	50	0	150	4
DC03	CH223	Momentum transfer	3	2	-	35	35	30	50	0	150	4
DC04	CH224	Chemical Engineering Thermodynamics	3	0	-	35	35	30	0	0	100	3
SDP3	ET235	Rapid Prototyping	0	4	-	0	0	0	0	75	75	2
SDP4	CH230	Minor Project - Design	0	2	-	0	0	0	0	50	50	1
ESC7	CV203	Environmental Sciences	1	0	-	-	-	-	-	-	Audit	
TOTAL			**16**	**12**	**0**	**175**	**175**	**150**	**100**	**175**	**775**	**21**

SEMESTER: IV												
COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
NSC5	AS203	Applied Mathematics	3	2	-	35	35	30	50	0	150	4
DC05	CH231	Heat Transfer	3	2	-	35	35	30	50	0	150	4
DC06	CH232	Advanced Chemistry	3	2	-	35	35	30	50	0	150	4
DC07	CH233	Mass Transfer	3	2	-	35	35	30	50	0	150	4
HSS3	HP202	Professional Skills	0	4	-	0	0	25	0	50	75	2
SDP5	ET224	Digital Prototyping	0	4	-	0	0	0	0	75	75	2
SDP6	CH240	Minor Project - Implementation	0	2	-	0	0	0	0	50	50	1
HSS4	HP203	Liberal Learning	1	0	-	-	-	-	-	-	Audit	
TOTAL			**13**	**18**	**0**	**140**	**140**	**145**	**200**	**175**	**800**	**21**

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF MECHANICAL AND CIVIL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Materials Engineering
	COURSE CODE	ME221
	COURSE CREDITS	4
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	NIL	50	150

PRE-REQUISITE :

COURSE OBJECTIVES:

ME221.CEO.1: To illustrate the fundamental properties of various engineering materials and demonstrate the need and applications of different heat treatment processes to it.

ME221.CEO.2: To explain the structure- property co relationship as a basis for performance of materials.

ME221.CEO.3: To identify the most appropriate material and the required manufacturing process for the given project in the industry/research fields.

ME221.CEO.4: To categorize the various material testing methods and characterization techniques and make use of it to apply for given component/product.

COURSE OUTCOMES:

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

ME221.CO.1: Relate the applications of various engineering materials and heat treatment processes in material processing industry.

ME221.CO.2: Interpret the specifications, composition, concepts and fundamental properties of engineering materials applied in industrial/research field.

ME221.CO.3: Select the suitable materials, manufacturing process for specified application to meet the product performance requirements within its product service life.

ME221.CO.4: Analyze the suitable material testing and characterization technique to ensure service life for specific product without any failure or deterioration in its performance.

THEORY COURSE CONTENT		
UNIT 1	**Ferrous, Nonferrous metals and alloys**	**14 HOURS**

Basics of extractive metallurgy-

Importance of metallurgy in day to day life and in industry, Overview or introduction of raw material processes of steel (Melting, Continuous casting, rolling)

Ferrous metals-

Steels-Classifications and specifications of steels and cast iron as per ASTM, SAE and Indian Standard designation system. Iron (Fe)-Iron Carbide (Fe3C) equilibrium diagram, Critical cooling rate, transformation products of Austenite-Pearlite-Martensite, Alloy steels- High Strength Low Alloy (HSLA), Boron steel, Stainless steel- Austenitic, Ferritic, Martensitic, Maraging steels- Significance, composition and applications.

Cast Irons- Classification, Manufacturing, Composition, Properties & applications of white C.I., Grey cast iron, malleable C.I., S.G. cast iron, chilled and alloy cast iron, effect of various parameters on structure and properties of cast irons. Specific applications such as machine tools, automobiles, pumps, valves etc.

Heat treatment of steels- Time- Temperature Transformation Diagram, Annealing-Conventional, Normalizing, Comparison of Annealing and Normalizing, Hardening- effects of different media- water, oil, salt bath, Vacuum Hardening (Latest oxygen free Heat treatment), Tempering- High-medium-low temperature Defects due to heat treatment- Quench cracks, oxidation, overheating. Classification of surface hardening treatments- Carburizing, Nitriding, Carbonitriding, flame hardening, induction hardening, Anodizing

Non-ferrous metals- Classification, Composition, Properties & applications of: Copper and Its Alloys-Alpha, beta and gamma brasses, Nickel and Its alloys-Inconel- Monel-Invar-Elnivar-Alnico, Aluminium and Its alloys-LM6-LM11- LM13-LM14-Hinduminium (RR350).

Bearing materials and its applications- Properties of bearing materials, Materials-Tin based babbits, Lead based babbits, Gray Cast Iron, Non-metallic bearings-Nylon, Polyamide, Self-lubricating bearings-powder metallurgical bearings

UNIT 2	**Non-metallic materials-Polymers, Ceramics and Composites**	**8 HOURS**

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, Barium Zirconium Titanate and Barium Calcium Titanate(BZT-BCT) Ferrites, Silicon Carbide, Alumina, Ceramics, its classifications and their applications. **High Performance Polymers:** Acrylo Butadiene Styrene- Polycarbonate-Polyamide, Polymethyl Methacrylate: Characteristic, properties and evaluation

Composites: Need of composites, fabrication and testing of composite material, Particle-reinforced composites, large-particle composites, dispersion-strengthened, Fiber-reinforced composites, polymer-matrix composites, metal-matrix composites, ceramic matrix composites, carboncarbon composites, structural composites, laminar composites. Case study for industrial applications.

UNIT 3	Strength of materials	6 HOURS

Strengthening mechanisms: Refinement of grain size, Cold working/strain hardening, Solid solution strengthening, Dispersion strengthening. Heat treatment of nonferrous metals: Precipitation, Age hardening and homogenization Creep strength, High temperature-intergranular and low temperature-trans granular fracture of materials, Fracture toughness properties of materials applied in cryogenic and high temperature- rocket and aerospace applications, Fracture toughness improvement methods-shot peening

UNIT 4	Powder metallurgical materials	8 HOURS

Basic steps of powder metallurgy process, classification & methods of powder manufacturing, characteristics of metal powders, Conditioning of metal powders (Screening, Blending & mixing, annealing), Compaction techniques (cold compaction, hot compaction, Isostatic compaction & powder rolling), mechanism & importance of sintering, Pre-sintering & sintering secondary operations.

Advantages, limitations and applications of powder metallurgy. Production of typical P/M components (with flow charts), self-lubricated bearing, cemented carbides, cermets, refractory metals, electrical contact materials, friction materials, and diamond impregnated tools, friction plate, clutch plate, commutator brushes.

UNIT 5	Corrosion and its prevention techniques	6 HOURS

Classification of corrosion- Dry corrosion & wet corrosion, Mechanism of corrosion, Types of corrosion: Pitting corrosion, stress corrosion, season cracking, Cavitation corrosion, caustic embrittlement, intergranular corrosion, crevice corrosion, erosion corrosion, uniform corrosion, galvanic corrosion,

Corrosion prevention methods- classification of different methods, e.g. inhibitors, Cathodic & anodic protection, internal & external coatings, Low & High temperature corrosion. Design against corrosion.

UNIT 6	Introduction to Advanced Materials-Nanomaterials, Magnetic, Piezoelectric materials	6 HOURS

Nanomaterials-Basic concepts of Nano science and Nanotechnology,Nanomaterials synthesis methods- Top down and bottom up approach, Sol gel technique, solution blending, laser vaporization, arc discharge method Carbon nanotubes and its classification, Graphene 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.AFSEM-Correlative SEM-AFM analysis

Magnetic materials- Soft & Hard Ferrites, Vibrating Sample Magnetometer for studying hysteresis curve of magnetic materials.

Dielectric material- Piezo electric and Ferro electric materials and their applications, superconductors. Modern Materials for high, low temperatures and Cryogenic applications

PRACTICAL: **Perform the following experiments.**		
PRACTICAL NO. 1	Jominy End Quench Test	**2 HOURS**
Jominy End Quench Test for hardenability.		
PRACTICAL NO. 2	Izod Impact Test	**2 HOURS**
Izod impact test		
PRACTICAL NO. 3	Charpy Impact Test	**2 HOURS**
Charpy impact test		
PRACTICAL NO. 4	Hardness Test	**2 HOURS**
Vickers hardness test		
PRACTICAL NO. 5	Hardness Test	**2 HOURS**
Rockwell hardness test		
PRACTICAL NO. 6	Hardness Test	**2 HOURS**
Poldi hardness test		
PRACTICAL NO. 7	Dye Penetrant Test	**2 HOURS**
Dye Penetrant Test for detection of surface level flaws in materials		
PRACTICAL NO. 8	Ultra-sonic Test	**2 HOURS**
Ultra-sonic test for detection of internal flaws in materials.		
PRACTICAL NO. 9	Case study-based experimentation	**4 HOURS**
Selection and performance of suitable hardness testing method for the given industrial components.		
PRACTICAL NO. 10	Microstructural analysis of steels	**2 HOURS**
Microstructural analysis of steels		
PRACTICAL NO. 11	Microstructural analysis of Cast irons	**2 HOURS**
Microstructural analysis of Cast irons		

TECHNICAL PAPER PRESENTATION/PUBLICATION ASSESSMENT PROCESS

1. Course champion should conduct meetings with faculty members, students from all disciplines for the given semester regarding following points-Importance of paper publication at SY level for placements/research work, plagiarism, research ethics, technical paper formation and publication process, demonstration of experimental and review paper formation.
2. Each faculty member should form students groups in practical session as per students interest domain selected from any content form the syllabus or from content beyond syllabus.
3. Each student groups will download the research papers, discuss the various technical points and doubts with peers and faculty member during the time left after conduction of practical in laboratory session as a continuous process for all weeks during semester.
4. In case of doubts are unsolved within particular practical session, then doubts are discussed within course meeting held weekly and the information is conveyed back to students to complete the loop.
5. Faculty members should display the list of Scopus/web of science indexed journals with no article processing fee or SPPU UGC CARE included journals list and list of conferences scheduled within the semester to students and motivate students to prepare drafts.
6. The drafts are prepared by students and reviewed by faculty member, team of materials Engineering and then DRC should be done to receive suggestions on the paper draft.
7. The evaluation of the assessment can be said as complete if students groups are able to
   (a) Publish the paper in journal or conference proceedings which are Scopus indexed or web of science indexed
   (b) Students group has received the acceptance for the publication of their paper.
8. In case any students group is not able to publish or receive the acceptance then minimum criteria is to communicate the paper and receive at least review 1 from reviewers of the paper with no major corrections. Communication to the journal for the paper with no major corrections and possibility of publication is mandatory for all project groups.

PROJECT BASED LEARNING- CONTENT BEYOND SYLLABUS

A group of 3 students will be given following set of experiments which needs to be performed to prepare a review report based on the practical observations, literature review discussions among peers and faculty members:

1. Identification of failure mode (cup/cone/brittle/ductile) of the given failed component obtained from any manufacturing company or workshop
2. Selection of suitable destructive and non-destructive testing method for the given component which has defects obtained from any manufacturing company or workshop

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Material and Energy Balance
	COURSE CODE	CH221
	COURSE CREDITS	3
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	35	35	30	NIL	NIL	100

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH221.CEO.1: Develop ideas in dimensional analysis and to be familiar with different unit systems and conversion from one set of system to another.

CH221.CEO.2: Understand the various unit operations and unit processes performed in chemical industry.

CH221.CEO.3: Learn the fundamentals of stoichiometry.

CH221.CEO.4: Apply different laws of conservation to solve material and energy balance problems.

CH221.CEO.5: Learn the general energy balance equation to precisely calculate the energy requirement for the given unit operation or process.

COURSE OUTCOMES :

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

CH221.CO.1: Interpret the data presented in different unit systems.

CH221.CO.2: Apply the various gas laws to calculate the unknowns in the given system.

CH221.CO.3: Develop the material balance equation for the given system.

CH221.CO.4: Analyze the heating value of the given fuel.

CH221.CO.5: Calculate the heat of reaction for the given reaction at the specific conditions.

CH221.CO.6: Calculate the energy requirement for the given system.

THEORY COURSE CONTENT		
UNIT 1	**Mathematical Principles and Physical Properties of Systems**	**7 HOURS**
Introduction to unit processes and operations and their symbols, process flow sheet. Concept of steady and unsteady state operations, Units and dimensions. Properties of pure substances, PVT behavior, ideal and real gas laws. Mole fractions and partial pressures, concept of vapor pressure, Raoult's law and its applications.		
UNIT 2	**Material Balance for Physical Systems**	**7 HOURS**
Concept of material balance calculations, recycling and bypass and Purge operations. Introduction to unsteady state processes, accumulation of inert components, etc.		
UNIT 3	**Unit Operations**	**7 HOURS**
Distillation, humidification, extraction, crystallization, psychrometry, drying, evaporation and industrial problems.		
UNIT 4	**Stoichiometry**	**7 HOURS**
Introduction to stoichiometry, Concept of limiting reactant, excess reactant, % excess, Conversion and yield calculations, recycle and By-pass, purging operations in reacting systems.		
UNIT 5	**Energy Balance**	**7 HOURS**
Concept, energy and Thermochemistry, Energy balances, heat capacity of pure substances and mixtures. Latent heats, enthalpy of pure substances and mixtures, absolute enthalpy, heat of reaction, adiabatic reactions, thermochemistry of mixing processes, dissolution, liquid-liquid mixtures, gas-liquid systems.		
UNIT 6	**Fuels and Combustion**	**7 HOURS**
Calorific values, coal, liquid fuels, gaseous fuels, air requirement and flue gases, combustion calculations.		

TEXT BOOKS

1. Bhatt B.I. and Vora S.M., Stoichiometry, 2nd Edition, Tata McGraw Hill, New Delhi, 2004, ISBN: 0070964041.
2. Hougen O.A., Watson R.M. and Ragatz R.A., Chemical Process Principles Part I, 2nd Edition, CBS Publications, 1976, ISBN: 9798123909539.
3. David M. Himmelblau, Basic Principles and Calculations in Chemical Engineering, 8th Edition, Prentice Hall of India, New Delhi, 2012, ISBN : 0132346605.

REFERENCE BOOKS

1. Narayanan. K.V. and Lakshmikutty.B, Stoichiometry and Process Calculations, 2nd Edition, Prentice Hall of India, New Delhi, 2009, ISBN: 8120329929.
2. Venkatramani V, Ananatharaman N, Sheriffa Begum, Process Calculations, 2nd Edition, Prentice Hall of India, 2011, ISBN: 9788120341999.
3. Richard M. Felder, Ronald W. Rousseau, Elementary Principles of Chemical Processes, 3rd Edition, John Wiley and Sons, 2005, ISBN : 9780471697596.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Inorganic and Analytical Chemistry
	COURSE CODE	CH222
	COURSE CREDITS	4
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH101 - Science of Nature

COURSE OBJECTIVES :

CH222.CEO.1: Understand the basic concepts of bonding of molecules in organic and inorganic compounds.
CH222.CEO.2: Learn transition metals and coordination compounds.
CH222.CEO.3: State the formation of different types of solutions.
CH222.CEO.4: Learn the technique of identification of organic molecules.
CH222.CEO.5: Study the different analytical techniques.
CH222.CEO.6: Impart the basic concept of biomolecules.

COURSE OUTCOMES :

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

CH222.CO.1: Predict the geometry of various chemical compounds.
CH222.CO.2: Appreciate the importance and applications of transition metals and coordination compounds in our day to day life.
CH222.CO.3: Describe Colligative properties of solutions and correlate these with molar masses of the solutes.
CH222.CO.4: Describe the basic principle of different analytical techniques.
CH222.CO.5: Suggest possible analytical techniques for identification and quantification of organic compounds.
CH222.CO.6: Apply the knowledge of various Biomolecules used in biochemical processes.

THEORY COURSE CONTENT		
UNIT 1	**Chemical Bonding and Molecular Structure**	**7 HOURS**
Valence Bond theory VSEPR and Molecular orbital theory, MO structures of s-s, s-p, p-p overlaps, molecular orbital structure of butadiene, benzene, MO energy diagrams for diatomic molecules H2, N2, O2, CO and NO.		
UNIT 2	**Transition Metals and Co-ordinaion Chemistry**	**7 HOURS**
Electronic configuration of first series transition metals shapes of d- orbital characteristics (variable oxidation states, magnetic property, colour of transition metal compounds) Nomenclature of complexes, Chelates, Theories of co-ordination- i) Werner ii) EAN iii) CFT (including crystal field splitting in octahedral field and tetrahedral field, CFSE for octahedral complexes , applications of CFT) electronic and magnetic properties of the complexes. Metal-metal bonds in alloys.		
UNIT 3	**Solutions**	**7 HOURS**
Solution of gas in gas, gases in liquid, Henry's law, the ideal solution, Raoult'1s law of ideal solution, solutions of liquids in liquids, theory of dilute solution. Colligative properties, osmosis, osmotic pressure, Colligative properties of dilute solution- lowering of vapor pressure, elevation of boiling point and thermodynamic derivation, depression in freezing point and thermodynamic derivation. Abnormal behavior of solutions of electrolytes, vant Hoff factor. Numericals on all above. Solid-Solid solutions and concept of alloys for use in metallurgy.		
UNIT 4	**Spectroscopy Techniques**	**7 HOURS**
Spectroscopic Techniques: Infra-Red Spectroscopy & FTIR, Basic Principles, working & Applications & Interpretation of IR Spectra.		
UNIT 5	**Chromatographic Techniques**	**7 HOURS**
TLC, GC, GPC, HPLC. Theory, instrumentation and applications.		
UNIT 6	**Bio Molecules**	**7 HOURS**
Four major biomolecules- Carbohydrates, Proteins, Introduction to Enzymes, fermentation and bio-catalysis Lipids and Nucleic acids: Molecular structure, classification and biological role.		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Preparation of tris ethylene diamine nickel (II) thiosulphate.		
PRACTICAL NO.02		**2 HOURS**
Preparation of tetramine copper (II) sulphate, pot. trioxalato aluminate.		
PRACTICAL NO.03		**2 HOURS**
To determine molecular weight of solid by Elevation in B.P		

PRACTICAL NO.04		**2 HOURS**
To find molecular wt. of solute by depression in freezing point of solvent.		
PRACTICAL NO.05		**2 HOURS**
Estimation of Cu2+/Ni2+ ions by spectrophotometer.		
PRACTICAL NO.06		**2 HOURS**
Preparation of osazone derivative of glucose.		
PRACTICAL NO.07		**2 HOURS**
Interpretation of IR Spectrum.		
PRACTICAL NO.08		**2 HOURS**
Analysis of sample on GC.		
PRACTICAL NO.09		**2 HOURS**
Analysis of sample on HPLC.		
PRACTICAL NO.10		**2 HOURS**
Separation of organic compound by column chromatography		
PRACTICAL NO.11		**2 HOURS**
Preparation and Properties of Biodiesel		

TEXT BOOKS

1. Puri, Sharma & Pathania, Inorganic Chemistry, Shoban Lal Nagin Chand & Co. ISBN : 9788188646999.
2. Gary D. Christian, Analytical Chemistry, 6th Edition, John Wiley and Sons Inc. ISBN : 9780471214724.
3. Soni P. L. Physical Chemistry, S. Chand & Company. ISBN 9788180545870.
4. David L Nelson, Lehninger Principles of Biochemistry 4th edition. ISBN 9780716743392.

REFERENCE BOOKS

1. Lee J.D, Inorganic chemistry , 5th Edition, (ELBS) Chapman & Hall.ISBN : 9780412402906.
2. Cotton, Wilkinson, Basic Inorganic chemistry , 3rd Edition, Wiley India Pvt. Ltd. ISBN 9780471505327.
3. Skoog and West, Fundamentals of Analytical Chemistry, 8th Edition, Thomson Asia. ISBN : 9780495558286.
4. P. S. Kalsi, Spectroscopy of Organic compounds New age international ISBN: 8122415431.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Momentum Transfer
	COURSE CODE	CH223
	COURSE CREDITS	4
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH223.CEO.1: Understand the basic concepts of fluid mechanics and its application.
CH223.CEO.2: Understand the fluid statics and principles of various pressure measuring devices.
CH223.CEO.3: Learn the fundamentals of fluid, valves and pumps used in pipelines.
CH223.CEO.4: Know about dimensional analysis and principles of similarity.
CH223.CEO.5: Understand the basic energy balance equations and their applications.
CH223.CEO.6: Learn the basic concepts of flow through pipelines.

COURSE OUTCOMES :

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

CH223.CO.1: Apply concepts of momentum transfer to different processes in chemical engineering.
CH223.CO.2: Find out the dimensions of unknown variable by using dimensional analysis.
CH223.CO.3: Calculate pressure drop by setting momentum balance.
CH223.CO.4: Perform design calculations related to flow measurements and pumping of fluids.
CH223.CO.5: Calculate different losses in piping.
CH223.CO.6: Apply the equation of motion.

THEORY COURSE CONTENT		
UNIT 1	**Introduction**	**7 HOURS**
Properties of fluids: Characteristics of fluids. Fluid Kinematics: Types of flows- visualization of flow-field (stream, path and streak Line), Stream function and velocity potential function, Newtons law of viscosity, rheological classification of fluids. Concept of atmospheric, gauge and absolute pressure, manometers, pressure measurement by simple and differential manometer.		
UNIT 2	**Fluid Dynamics**	**7 HOURS**
Continuity equation, equation of motion, Bernoulli equation, Eulers and Navier - Stokes equations, flow measurement using venturimeter, orificemeter, rotameter and pitot tube, flow through notches and weirs.		
UNIT 3	**Flow of incompressible Fluid through Pipe**	**7 HOURS**
Shear stress distribution, relation between skin friction and wall shear, friction factor, laminar flow through circular pipe, on inclined plane, relation between average and maximum velocity, major And minor losses, Darcy Weisbach equation, friction factor chart.		
UNIT 4	**Boundary Layer and Dimensional Analysis**	**7 HOURS**
Concept of hydrodynamic boundary layer, growth over a flat plate, different thickness of boundary layer. Fundamental dimensions of quantities, dimensional homogeneity, dimensional analysis by Rayleighs method and Buckinghams method, dimensionless numbers.		
UNIT 5	**Fluid Moving Machinery**	**8 HOURS**
Pumps: Types of pumps, centrifugal pump, performance of centrifugal pump. Compressors: Working and applications of Centrifugal and reciprocating compressors Valves : Gate Valve, Globe Vale, Butterfly valve, etc.		
UNIT 6	**Introduction to CFD**	**6 HOURS**
Governing equations of fluid flow, mass conservation, momentum and energy equation, differential and integral forms, conservation and non-conservation form. Characteristics of turbulent flows, time averaged Navier Strokes equations.		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Estimation of kinematic viscosity of Oil		
PRACTICAL NO.02		**2 HOURS**
Calibration of Venturimeter & Orifice meter		
PRACTICAL NO.03		**2 HOURS**
Reynolds Experiment		
PRACTICAL NO.04		**2 HOURS**
Verification of Bernouli's equation		
PRACTICAL NO.05		**2 HOURS**
Calibration of Rotameter		
PRACTICAL NO.06		**2 HOURS**
Calibration of Notches		
PRACTICAL NO.07		**2 HOURS**
Minor & Major losses in Pipe flow		
PRACTICAL NO.08		**2 HOURS**
Characteristics of Centrifugal Pump		
PRACTICAL NO.09		**2 HOURS**
Introduction to Ansys - Geometry Modelling, Meshing Approach & Mesh and Creating a Structured Grid		
PRACTICAL NO.10		**2 HOURS**
Basic approaches to integrating experiments in fluid mechanics with CFD		
PRACTICAL NO.11		**2 HOURS**
Study of flow through circular pipe using CFD		
PRACTICAL NO.12		**2 HOURS**
Study of flow in inclined plane using CFD		

TEXT BOOKS

1. Dr Bansal R.K, A Text book of Fluid Mechanics and Hydraulic Machines , 6th edition, Laxmi Publications, 1997. ISBN : 8131808157.
2. Dr Modi P.N and Dr Seth S.M, Hydraulics and Fluid Mechanics , 11th Edition, Standard Book House, 2004. ISBN : 8190089374
3. Yunus A. Cengel, Fluid Mechanics: Fundamentals and Applications 3rd Edition, Tata McGraw-Hill Education. ISBN 9789339204655.

REFERENCE BOOKS

1. White F.M., "Fluid Mechanics , 3rd Edition, McGraw Hill Inc., 1994. ISBN : 9780070696730.
2. Shames I.H, "Mechanics of Fluids", 3rd Edition, McGraw Hill Inc., 1992.ISBN : 9780070563872.
3. Noel de Nevers, Fluid Mechanics for Chemical Engineers , 2nd Edition, McGraw Hill Inc, 1991. ISBN : 0070163758.
4. Daugherty R.L, Franzini J.B and Finnemore E.J., "Fluid Mechanics with Engineering Applications", 10th Edition, McGraw Hill Book Company, 2006.ISBN : 9781259002274.
5. Streeter V.L, Wylie E.B, "Fluid Mechanics", 9th Edition, McGraw Hill Book Company, 2010. ISBN : 0070625379.
6. Liggett J.A, Fluid Mechanics", International Edition, McGraw Hill Inc., 1994.ISBN: 9780070378056

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Chemical Engineering Thermodynamics
	COURSE CODE	CH224
	COURSE CREDITS	3
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	35	35	30	NIL	NIL	100

PRE-REQUISITE : 11th and 12th Standard Chemistry

COURSE OBJECTIVES :

CH224.CEO.1: Know the concept of thermodynamics and its applications in chemical engineering.
CH224.CEO.2: Get information about the various thermodynamic properties and their applications.
CH224.CEO.3: Get knowledge about heat effects and applications.
CH224.CEO.4: Understand the phase and chemical reaction equilibrium with its applications.
CH224.CEO.5: Learn the various thermodynamic relations.
CH224.CEO.6: Know the real thermodynamic applications.

COURSE OUTCOMES :

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

CH224.CO.1: State the importance of thermodynamic laws and their applications in chemical engineering.
CH224.CO.2: Evaluate the thermodynamic properties of pure substances as well as mixtures.
CH224.CO.3: Apply the knowledge of thermodynamics in chemical engineering problems.
CH224.CO.4: Use appropriate thermodynamic models to predict the equilibrium characteristics of a system.
CH224.CO.5: Implement knowledge of heat cycles in day to day applications.
CH224.CO.6: Evaluate the feasibility of a reaction using thermodynamic concepts.

THEORY COURSE CONTENT		
UNIT 1	**Basic Concepts and Laws of Thermodynamics**	**7 HOURS**
First law for thermodynamics - flow process, non-flow process, cyclic process; Internal energy, Enthalpy, Heat capacity, Processes involving ideal gases isochoric process, isobaric process, isothermal process, adiabatic process; Second law of thermodynamics, Entropy, Carnot principle, Clausius inequality, Third law of thermodynamics.		
UNIT 2	**Applications of Thermodynamic Laws**	**7 HOURS**
PVT behavior of pure fluids, Equations of state - Van der Waals equation, Soave-Redlich-Kwong equation, Peng-Robinson equation, virial equation; Compressibility charts, Heat effects accompanying chemical reactions - heat of formation, heat of combustion, heat of reaction, Hesss law of constant heat summation; Refrigeration - vapour compression, air refrigeration, absorption refrigeration; Heat pumps.		
UNIT 3	**Thermodynamic Properties of Pure Fluids**	**7 HOURS**
Helmholtz free energy, Gibbs free energy, Fundamental property relations, Maxwells equations, Clapeyron equation, Entropy-heat capacity relationships, Joule-Thomson coefficient, Gibbs-Helmholtz equation, Fugacity, Fugacity coefficient, Activity, Residual properties.		
UNIT 4	**Solution Thermodynamics**	**7 HOURS**
Partial molar properties, Chemical potential, Fugacity in solutions, Lewis-Randall rule, Raoults law, Henrys law, Activity in solutions, Activity coefficients, Gibbs-Duhem equations, Property changes of mixing, Excess properties.		
UNIT 5	**Phase Equilibrium**	**7 HOURS**
Phase equilibria in single component systems, Phase equilibria in multi-component systems, Phase rule for non-reacting systems, Duhems theorem, Vapour-Liquid equilibria, Phase diagrams, Consistency tests for VLE data, VLE for systems of limited miscibility, Liquid-Liquid equilibria.		
UNIT 6	**Chemical Reaction Equilibrium**	**7 HOURS**
Equilibrium constant and standard free energy change, Effect of temperature on equilibrium constant, Effect of pressure on equilibrium constant, Other factors affecting equilibrium conversion, Heterogeneous reaction equilibria, Simultaneous reactions, Phase rule for reacting systems.		

TEXT BOOKS

1. Narayanan K. V., A Textbook of Chemical Engineering Thermodynamics, PHI Learning Pvt. Ltd., 2nd Edition, 2013, ISBN: 9788120347472.
2. Rao Y. V. C., Chemical Engineering Thermodynamics, Universities Press, 1st Edition, 1997, ISBN:9788173710483.

REFERENCE BOOKS

1. Smith J. M., Van Ness H. C., Abbott M. M., Swihart M. T., Introduction to Chemical Engineering Thermodynamics, McGraw-Hill Education, 8th Edition, 2017, ISBN:9781259696527.
2. Koretsky M. D., Engineering and Chemical Thermodynamics, Wiley, 2nd Edition, 2012, ISBN: 9780470259610.
3. Daubert T. E., Chemical Engineering Thermodynamics, McGraw-Hill, 1st Edition, 1985, ISBN:9780070154131.
4. Sandler S. I., Chemical and Engineering Thermodynamics, John Wiley & Sons, 3rd Edition, 1998, ISBN1:9780471182108.
5. Walas S. M., Phase Equilibria in Chemical Engineering, Butterworth-Heinemann, 1st Edition, 1985, ISBN1:9780750693134.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF ELECTRICAL ENGINEERING	**W.E.F**	2020 - 2021 (Rev.2019)
SECOND YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Rapid Prototyping
	COURSE CODE	ET235
	COURSE CREDITS	2
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

ET235.CEO.1: To learn about materiality and techniques.
ET235.CEO.2: To justify the product development cycle through prototype project.
ET235.CEO.3: To inculcate implementation of skills by proper budget planning with effective troubleshooting and practices in aesthetics & ergonomics.
ET235.CEO.4: To 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,

ET235.CO.1: Consolidate the techniques, skills and modern engineering tools.
ET235.CO.2: Apply acquired skills to the construction of a prototype project.
ET235.CO.3: Develop a prototype project by performing tasks in team.
ET235.CO.4: Demonstrate the work carried out in a team.

PRACTICAL

Course Introduction:

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.

Students will complete four modules in rotational manner,

1. Mechanical Prototyping (MP)
2. Civil Prototyping (CP)

In Mechanical prototyping, students will learn rapid prototyping skills. Students will focus on basics of CAD modeling, hands on practice on CAD software, 3D Modeling , 3D Printing, Fabrication of prototype and testing etc.

On the contrary in civil prototyping students will learn developing bamboo structures by testing and analyzing bamboo, designing bamboo joinery, and testing of bamboo structures.

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.

Marks of two modules at a time will be averaged in one semester and if student secures passing marks (passing grade) after averaging; then the required credits of the course will be earned.

For Rapid Prototyping, Semester - III

Module	**Programs**
a) Mechanical Prototyping (MP)	SY BTECH Civil Engineering, Mechanical Engineering, Chemical Engineering
b) Civil Prototyping (CP)	

For Digital Prototyping, Semester - IV

Module	**Programs**
a) Mechanical Prototyping (MP)	SY BTECH Electronics Engineering, Electronics & Telecommunication Engineering, Computer Engineering, Information technology
b) Civil Prototyping (CP)	

MODULE: 1/2	Mechanical Prototyping (MP)	28 HOURS

PRACTICAL:

PRACTICAL NO. 01	Introduction to prototyping	04 HOURS

1. Introduction to different prototyping, traditional prototyping vs. advance rapid prototyping, different types of prototyping techniques (clay modeling, casting, carpentry, metal art etc.) and their working principle.
2. Different types of materials used in prototyping model.
3. Introduction of multi axis (4D and 5D) machines used in prototyping and machining.
4. Making of paper prototyping (virtual or physical).
5. Applications and need of prototype in emerging field like Bio - medicals, defense, manufacturing, aerospace etc.

PRACTICAL NO. 2a	Basics of CAD modeling	04 HOURS

1. Introduction of CAD software.
2. Introduction of 2D, 3D Modeling using CAD software package.
3. Hands on practice of CATIA or any other CAD software.
4. Formation of students group per project team.

PRACTICAL NO. 2b	3D Modeling for prototyping	04 HOURS

1. Introduction of 3D modelling and its interaction with prototype machine
2. Identify physical constraints of prototyping.
3. Sketcher-workbench and its applications
4. Part design workbench.
5. Preparation of 3D prototyping model by CAD software for final project

PRACTICAL NO. 03	Preprocessing of 3D printing slicing	03 HOURS

1. Generating STL files of 3D models from CAD software & working on STL files.
2. Pre-Processing the 3D Model in Cuba software / kisslicer - repeater for slicing.
3. Selection of orientation of model, support generation, skin and wall thickness- depth setting.
4. Setting of printing speed, flow rate, volume, mass and time require for printing or manufacturing.
5. Practice of slicing on 3D Cad model and decide optimize parameters.

PRACTICAL NO. 04	Orientation and support generation, manufacturing planning	03 HOURS

1. Suitable filament material for 3D printing and selection and its properties.
2. Selection of material and process for making physical models by other tradition methods (machining, wood, clay, paper, polymer, etc).
3. Slicing pattern, tool path generation, G Code and gives input to prototype machine for actual part/object manufacturing.

PRACTICAL NO. 05	Manufacturing and fabrication of model	06 HOURS

1. Introduction 3D printer machines, and other machines used for prototyping.
2. Demonstration of 3D printing machine pre-setting and filament material loading.
3. Hands on experience of rapid prototype machine for part/object/model, manufacturing of conventional prototype model if any, assembly if required.
4. Calculation of cost of product, financial aspect, Bill of material (BOM), testing for prototyping, Plan to promote product/model in market, etc.

PRACTICAL NO. 06	Project presentation	02 HOURS

1. Final Presentation and demonstration of models.
2. Report submission (assessment).

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.

MODULE: 2/2	Civil Prototyping (CP))	28 HOURS
PRACTICAL:		
PRACTICAL NO. 01	**Introduction to civil prototyping**	**02 HOURS**
Introduction of bamboo, its physical, mechanical properties, selection, seasoning and treatment, case studies of bamboo structures.		
PRACTICAL NO. 02	**Testing & Analysis of Bamboo**	**04 HOURS**
Study of different test on Bamboo & Analysis of structures made by bamboo.		
PRACTICAL NO. 03	**Design of bamboo Joinery**	**04 HOURS**
Study of different bamboo structures, Hands on different types of joinery, axial and angular joints by different methods		
PRACTICAL NO. 04	**Making bamboo structures**	**08 HOURS**
Making of bamboo structures		
PRACTICAL NO. 05	**Testing on bamboo structure (Post Testing)**	**04 HOURS**
Testing of different bamboo structures		
PRACTICAL NO. 06	**Final project presentation**	**04 HOURS**
Comparative study of analytical and test results of the bamboo Structure, 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:
    - IS 1902:1993.Code of Practice for preservation of bamboo and cane for non-structural purposes.
    - IS 6874:1973 Methods of test for round bamboos
    - IS 7344:1974 Specification for bamboo tent bamboos.
    - IS 8242:1976 Methods of tests for split bamboos
    - IS 8295 (Part 1): 1976 Specification for bamboo chicks
    - ISO 22157 Standard guidelines for tensile, compressive, shear and bending Strength Parallel to grain and Perpendicular to grain.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Minor Project - Design
	COURSE CODE	CH230
	COURSE CREDITS	1
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH230.CEO.1: To categorize and define a problem to be solved.
CH230.CEO.2: To realize the ethical principles in general and its importance.
CH230.CEO.3: To make the students aware of project requirement analysis, design and planning.
CH230.CEO.4: To appreciate the importance of documenting and ethics of writing.

COURSE OUTCOMES :

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

CH230.CO.1: Delineate the problem to be solved.
CH230.CO.2: Comprehend the paramount of the health, safety and welfare of the public in the practice of engineering profession.
CH230.CO.3: Embark project planning and design.
CH230.CO.4: Inculcate problem solving skills and critically analyze the options available to solve the problem.
CH230.CO.5: Cognize the importance of documentation and report writing.

COURSE ABSTRACT

It is a need of the time to pay attention to the societal needs by an engineering graduate to solve some of the real life societal problems by providing affordable technological solutions. The concept of the 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. This will help students to understand the process of product/project development, best practices and encourage their creativity to solve real life problems. The students will learn effective team building, designing, budgeting, planning, engineering skills and processes, safety norms and standards while developing the application/ product. The students will be able to understand importance of documentation and professional ethics.

Guidelines

1. Every student shall undertake the Minor Project in semester III and IV.
2. Every student shall work on an approved project, a group of 03/04 students (maximum) shall be allotted for each minor project.
3. The group members may be from different programme to support the interdisciplinary functioning.
4. The students have to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
5. Collect the sufficient data and survey to establish the criticality of the problem to be solved.
6. Apply various tools for project planning and design.
7. Critically analyze various solutions/techniques to solve real world problems.
8. Select and justify one of the solutions identified based on the feasibility, affordability and ease of use.
9. Learn and apply standards of engineering ethics and professional behavior.
10. Adherence to the highest principles of ethics, conduct and practices.

TIMELINE

The four member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Formation of Project Group: 2 Weeks (1^{st} week and 2^{nd} week)
2. Finalizing title, feasibility study and approval: 3 Weeks (3^{th} week to 5^{th} week)
3. Engineering Ethics: 3^{rd} week
4. Project Review 1 Presentation: 6^{th} week
5. Analysis and Design of the Project: 3 Weeks (7^{th} week to 9^{th} week)
6. Project Review 2 Presentation: 10^{th} week
7. Report Writing, Documentation and Presentation: 2 Weeks (11^{th} week and 12^{th} week)
8. Project Review 3 Presentation: 13^{th} week (Assessment by Guide)
9. Final Evaluation/Examination Presentation: 14^{th} week

Project Demonstration (50 Marks)

1. **Review 1 (Problem Statement and Literature Survey) (10 marks)**
2. **Review 2 (Project Modeling and Designing) (10 marks)**
3. **Project Activities (10 Marks)**
    - Quiz on Ethics
    - Drafting of Literature Review and Synopsis
    - Project Planning and Design
4. **Review 3 (Project Documentation) (10 marks)**
5. **Final Demonstration & Presentation (10 marks)**

WEEK NO	INSTRUCTIONS	STUDENT'S GROUP ACTIVITIES	EXPECTED OUTCOME
Week 1	Introduction to different forefront areas available within the School. Discussion on innovative application in domain area and resources such as Books, Blog, Publication Houses	To search the domain area of interest	At least 4 subtopics in area of interest (Template I)
Week 2	To brief at least two Innovative products with complete details and their Evolution	To search the domain area/innovative products of interest	Search in area of interest (Template II)
Week 3	Ethics, Morals, Values and Integrity, Work Ethic, Civic Virtue, Senses of Engineering Ethics, Business Ethics, Media Ethics, Environmental Ethics, Bio Ethics, Computer Ethics, Research Ethics	Graded Activity Quiz on Engineering Ethics	Understand the Ethics of an Engineer (Template III)
Week 4	Introduction to Research publication, its type, science citation index, methods to search Journals. Introduction to Ethics of writing(Plagiarism)	Search domain related five papers (from Journal Paper, Conference paper, Technical report, Manual, Thesis)	Student will learn searching SCI journal and understand Ethics of writing
Week 5	Presentation on how to make Project Presentation. Title, problem statement, objective, Scope etc (Select suitable topic of domain and explain it as per the template-IV)	Graded Activity on background study (market survey, customer survey, literature Survey) of domain area of interest	Drafting literature review and Synopsis (Template IV)
Week 6	NIL	Project Review 1 Presentation	Problem Definition and Objectives

WEEK NO	INSTRUCTIONS	STUDENT'S GROUP ACTIVITIES	EXPECTED OUTCOME
Week 7	Guidelines and tools for Analysis and Design of the Project and problem solving sessions	Analysis and Design of the Project	Best practices for Analysis and Design
Week 8	Guidelines and tools for the Project Planning, Introduction to Block Diagram, System Architecture	Make use of Project Planning Tools and Design Tools	Best practices for Project Planning and Design
Week 9	Presentation, discussion and doubt clearing based on • Working on Algorithms • Working on Design/ System Architecture • Working on Analysis/ CAD modeling	Graded Activity on Project Design and Planning	Best practices of Project Planning and Design
Week 10	NIL	Project Review 2 Presentation	Project Planning, Design of a solution
Week 11	Guidelines and tools for report writing	Project Report Writing	Effective Report Writing Practices
Week 12	How to give effective presentation on project	Report Writing and Presentation	Effective Documentation of the Project
Week 13	NIL	Project Review 3 Presentation	Final Report and Presentation
Week 14	NIL	Examination: Final Demonstration and Presentation	Problem Statement, Objectives, Design and Planning

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF MECHANICAL AND CIVIL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Environmental Science
	COURSE CODE	CV203
	COURSE CREDITS	AUDIT
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CV203.CEO.1: Create awareness about environmental problems among future citizens.
CV203.CEO.2: Interpret basic knowledge about the environment and its allied problems.
CV203.CEO.3: Develop an attitude of responsibility for the environment and society.
CV203.CEO.4: Acquire skills to identify and solve environmental problems.
CV203.CEO.5: Perceive the importance of sustainable development
CV203.CEO.6: Strive to attain harmony with nature.

COURSE OUTCOMES :

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

CV203.CO.1: summarize the importance of ecosystem and biodiversity for maintaining ecological balance.
CV203.CO.2: identify environmental problems arising due to engineering and technological activities and the science behind those problems
CV203.CO.3: categorize the major pollutants along with sources and abatement devices for the environmental management.
CV203.CO.4: analyze material balance for different environmental systems.
CV203.CO.5: perceive the social and professional responsibility towards the environment.
CV203.CO.6: appraise the environmental factors so as to ensure sustainable development

Activity Based Learning and Evaluation		
Activity No. 1	**Any of the following activity can be selected by students**	**2 HOURS**
Students have to select any one of the following activities and prepare the detailed report on it along with the statistics or photos. This could be completed individually or in group of students: 1. Calculate individual (per capita) use of water for a day and find ways to reduce that use. 2. Make presentations for awareness regarding water resources among students, villagers and local people (at least 10 households). 3. Find out individual activities which lead to various types of pollution and suggest possible preventive measures for it. 4. Explore and register varieties of plants in the institute campus or Alandi city or its surroundings and prepare the biodiversity register. 5. Study any threatened bird or animal.		
Activity No. 2	**Site Visit**	**2 HOURS**
Students have to visit any one non hazardous polluted site for finding the various reasons of its pollution and suggest preventive measures for it. Prepare the detailed report on it along with the photos. This could be completed in a group.		
Activity No. 3	**Any of the following activity can be organized by students**	**4 HOURS**
Students have to organize any one of the following activities in the institute and prepare a detailed report on their experience of organizing the activity, its possible benefits to the environment along with the photos. This could be completed in group of students: 1. No Car and Bike Day 2. Shutting down the fans and air conditioning systems of the campus for an hour. 3. Environmental awareness programs like organizing essay competition, poster competition, slogan making competition or any other related to it. 4. Celebrating various environmental days. 5. Any other similar activity related to the environment.		
Activity No. 4	**Expert Lecture**	**2 HOURS**
Instructor has to plan an expert lecture on use of recent technologies for environmental monitoring. Students have to prepare a detailed report on it.		
Activity No. 5	**Project Work**	**10 HOURS**
Students have to identify the real life environmental problems from their daily observations and try to find out the various feasible solutions for it as their project work. They are supposed to prepare the prototype or poster, detailed report and present it to the evaluators. The project should be related to the below mentioned heads: 1. Reuse, Recycle and Reduce 2. Environmental Pollution Monitoring and Control 3. Material Balance Concept 4. Sustainable Development 5. Environmental Innovations The evaluation is based on at least two number of project presentation reviews apart from the final project presentation.		

TEXT BOOK

1. R. J. Ranjit Daniels and Jagdish Krishnaswamy, Environmental Studies, Wiley India Publications, ISBN: 9788126519439.
2. Rao C.S. Environmental Pollution Control Engineering, Wiley Eastern Publications, ISBN: 9780470217634.
3. Cunningham W.P. and Cunningham M.A., Principles of Environmental Science, Tata McGraw-Hill Publishing Company, New Delhi, 2002.
4. Miller T. G. Jr., Environmental Science, Wadsworth Publishing Co., ISBN-10: 1111988935 ISBN: 9781111988937.

REFERENCE BOOK

1. H. S. Peavy, D. R. Rowe and G. Tchobanoglous, Environmental Engineering, McGraw Hill, ISBN: 84-282-0447-0.
2. Helen Kavitha Principles of Environmental Science, Sci tech Publications, 2nd Edition, 2008. ISBN: 9780444430243.
3. Henry J.G. and Heinke G.W., Environmental Science and Engineering, 2nd Edition, Prentice Hall of India, New Delhi, 2004, ISBN: 978-0131206502.
4. Metcalf Eddy Wastewater engineering: Treatment and reuse, McGraw Hill, ISBN: 007041878.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	2019 - 2020
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	COURSE NAME	Student Internship Program (Life/Soft Skills)
	COURSE CODE	CH200
	COURSE CREDITS	Audit
RELEASE DATE : 01/07/2019	REVISION NO	0.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH200.CEO.1: To develop good bahavioural practices
CH200.CEO.2: To gain learning and living experience
CH200.CEO.3: To get acquainted with online learning platforms
CH200.CEO.4: To recognize the latest trend and understand the requirements for professional life
CH200.CEO.5: To formulate the problem statement

COURSE OUTCOMES :

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

CH200.CO.1: Manage emotions, health, finances, relationships, performance extracurricular activities
CH200.CO.2: Increase knowledge of emotional competency and emotional intelligence
CH200.CO.3: Develop interpersonal skills and adopt good leadership behavior
CH200.CO.4: Reduce negative stress while promoting energy or positive stress
CH200.CO.5: Inculcate a sense of sportsmanship, better physical health and competitive spirit

INTRODUCTION:

The main aim of this internship is to assist all Second Year B.Tech. students to acquire the skills required for personal stability and professional growth. The ultimate goal is to imbue students with professionalism and life skills. Using this internship, MITAoE students will enhance their professional skills, making themselves more marketable in todays competitive world. The students can develop various extracuurricular skills for working on emotional intelligence and sportsman spirit.

SCOPE AND STRUCTURE OF SIP:

Student Internship Program (Life/Soft Skills) is offered to entrants of Second Year B.Tech. (after semester II) that meet the eligibility criteria stated below:
Second Year B.Tech. entrants should apply for 3 to 4 weeks duration life skill courses during June-July of every academic year.This is an audit course.

The scope of this internship is limited to identifying life skill development opportunities and assisting MITAoE students to apply for such courses.

STUDENT ELIGIBILITY CRITERIA:

Students applying for internship must meet the following criteria:
After completion of second academic semester, First Year B.Tech. students (Second Year B.Tech. entrants) of all schools are eligible to apply for 3 to 4 weeks duration internships under Student Internship Program.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Applied Mathematics
	COURSE CODE	AS203
	COURSE CREDITS	4
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

AS203.CEO.1: To evaluate the Laplace and inverse transform of functions.

AS203.CEO.2: To evaluate the Fourier series of periodic functions and Fourier transform of non-periodic functions.

AS203.CEO.3: To evaluate the derivative of vector-valued functions.

AS203.CEO.4: To evaluate the area and the surface integrals of the vector functions.

AS203.CEO.5: To apply numerical methods for solving the problems of general calculus and differential equations.

AS203.CEO.6: To execute the program on problems of numerical methods using MATLAB.

COURSE OUTCOMES :

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

AS203.CO.1: Evaluate the Laplace and Inverse Laplace transform and will solve the differential equations.

AS203.CO.2: Rewrite the periodic and non-periodic functions as a series of sines and cosines.

AS203.CO.3: Differentiate a vector valued function in plane or space.

AS203.CO.4: Solve and compute the area and volume of the objects.

AS203.CO.5: Apply the numerical methods to problems of calculus and differential equations.

AS203.CO.6: Execute the program codes using MATLAB.

THEORY		
UNIT 1	**Laplace Transform and its Applications to LDE**	**9 HOURS**
Introduction of Laplace Transform, Properties: First shifting, Change of scale, Linearity, Multiplication by t, Division by t. Laplace Transform of derivatives, Unit Step function, Impulse Function and Periodic Functions. Introduction of Inverse Laplace Transform, Properties: First shifting, Change of scale, Linearity, Multiplication by s, Division by s. Derivatives, Integration. Use of partial fractions to find Inverse Laplace Transform. Applications of Laplace Transfrom to find Solution of linear differential equations.		
UNIT 2	**Vector Differentiation**	**6 HOURS**
Vectors in 2-D and 3-D, Scalar Product, Vector Product, Vector/scalar functions and fields, Derivative of vectors, Velocity and Acceleration, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field.		
UNIT 3	**Vector Integration**	**6 HOURS**
Line Integration, Line Integrals Independent of Path, Double Integrals Green's Theorem in the Plane, Surfaces for Surface Integrals. Surface Integrals, Volume Integrals, Divergence Theorem, Stoke's Theorem.		
UNIT 4	**Fourier Series and Fourier Transform**	**9 HOURS**
Periodic functions, Fourier series, Dirichlets conditions, determination of Fourier constants, Half ranges series, arbitrary period functions series. Introduction of Fourier Transform, Fourier Integral Theorem (without proof), Fourier transform and its properties, Fourier Sine Transform, Fourier Cosine Transform, and Inverse Fourier transforms.		
UNIT 5	**Numerical Methods I**	**6 HOURS**
Numerical Differentiation and Integration, Interpolation: Finite Differences, Newtons and Lagranges Interpolation. Numerical solution of System of linear equations by Gauss elimination method, LU-Decomposition method.		
UNIT 6	**Numerical Methods II**	**6 HOURS**
Solution of Ordinary differential equations by Eulers, Modified Eulers, Runge-Kutta 4th order methods, Adams-Bashforth Predictor and Corrector Method, Solution of Partial Differential equations by Numerical method: Crank Nicholson method .		

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

TEXT BOOK

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10 th edition, Wiley Eastern Ltd., 2015, ISBN: 13: 9788126554232.
2. Dr. B.V. Ramana, Higher Engineering Mathematics, 5 th edition, Tata McGraw Hill, 2017, ISBN: 978-0-07-063419-0.
3. Amos Gilat, MATLAB: An Introduction with Applications, 4th edition, Wiley Publication, 2010, ISBN-13: 978-0-470-76785-6.

REFERENCE BOOK

1. B.S. Grewal, Higher Engineering Mathematics, 44 th edition, Khanna Publications, 2018, ISBN: 978-81-933284-9-1.
2. Ram N. Patel and Ankush Mittal, Programming in MATLAB- A Problem solving approach, Pearson Education, 2014, ISBN-978-93-325-2481-1.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Heat Transfer
	COURSE CODE	CH231
	COURSE CREDITS	4
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH231.CEO.1: Learn the different modes of heat transfer and the concept of conductive heat transfer..

CH231.CEO.2: Understand the concept of convection and overall combined heat transfer coefficient for conduction-convection in process heat exchangers.

CH231.CEO.3: Learn heat transfer involving phase changes such as condensation and boiling.

CH231.CEO.4: Study concept of radiation energy and the radiation between surfaces including various theories related to heat radiation.

CH231.CEO.5: Study various heat exchange equipment used in process industry.

CH231.CEO.6: Provide the basic tools those are used in thermal system design and to expose students to heat transfer applications in industry.

COURSE OUTCOMES :

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

CH231.CO.1: Identify the different modes of heat transfer and use the conduction calculations for various geometries.

CH231.CO.2: Apply the principles of convection for thermal systems.

CH231.CO.3: Implement the concepts of heat transfer with phase changes.

CH231.CO.4: Analyze the systems involving radiation and to solve problems pertaining to them.

CH231.CO.5: Analyze different types of heat exchangers based on fundamental concepts.

CH231.CO.6: Develop the basic designs of heat transfer equipment.

THEORY COURSE CONTENT		
UNIT 1	**Conduction**	**7 HOURS**
Importance of heat transfer in chemical engineering operations, modes of heat transfer, concept of heat conduction, Fouriers law of heat conduction, one dimensional steady state heat conduction equation for flat plate, hollow cylinder, hollow sphere, heat conduction through a series of resistances, analogy between flow of heat and flow of electricity, thermal conductivity measurement, effect of temperature on thermal conductivity, conduction through liquids, two dimensional steady state conduction, transient heat conduction, conduction with heat source.		
UNIT 2	**Convection**	**7 HOURS**
Concept of heat transfer by convection, natural and forced convection, application of dimensional analysis for convection, equations for forced convection under laminar, transition and turbulent conditions, equations for natural convection, individual and overall heat transfer coefficients and the relationship between them , Combined natural and forced convection.		
UNIT 3	**Heat Transfer with Phase Change**	**7 HOURS**
Heat transfer from condensing vapors, heat transfer to boiling liquids, influence of boundary layer on heat transfer, heat transfer to molten metals, heat transfer in packed and fluidized beds, thermal contact resistance, Heat conduction in bodies with heat sources.		
UNIT 4	**Radiation**	**7 HOURS**
Basic ideas, spectrum, basic definitions, laws of radiation, black body radiation, plancks law, Stefan boltzman law, wiens displacement law, lambert cosine law, radiation exchange between black surfaces, shape factor, radiation exchange between gray surfaces radiosity-Irradiation method, Parallel plates, enclosures, radiation shields, basics of radiative heat transfer and application to furnace design, electrical network for radiation through absorbing and transmitting medium.		
UNIT 5	**Heat Exchangers**	**8 HOURS**
Parallel and counter flow heat exchangers, log mean temperature difference, single pass and multi pass heat exchangers, plate heat exchangers, use of correction factor charts, heat exchangers effectiveness, number of transfer unit, chart for different configurations, fouling factors and Wilsons plot, design of various types of heat exchangers, design of furnaces, design of condensers, design of tubular reactors, Heat transfer effectiveness and number of transfer units.		
UNIT 6	**Heat Transfer in Agitated Vessels**	**6 HOURS**
Heat transfer in agitated vessels: coils, jackets, limped coils, calculation of heat transfer coefficients, heating and cooling times, applications to batch reactors and batch processes, Agitation of liquids or heterogeneous systems.		

PRACTICAL		
PRACTICAL NO.01	**Thermal conductivity of metallic and non metallic materials**	**2 HOURS**
To study variation of thermal conductivity of metal rod and insulating powder with temperature		
PRACTICAL NO.02	**Thermal conductivity of composite slab**	**2 HOURS**
To determine the thermal conductivity of composite wall		
PRACTICAL NO.03	**Heat transfer in Forced Convection**	**2 HOURS**
To study the variation of heat transfer coefficient over a horizontal circular pipe in forced convection		
PRACTICAL NO.04	**Heat transfer in pin fin apparatus**	**2 HOURS**
To study the temperature distribution in pin fin and to evaluate the fin performance under natural convection		
PRACTICAL NO.05	**Emissivity measurement apparatus**	**2 HOURS**
Emissivity measurement apparatus		
PRACTICAL NO.06	**Critical heat flux apparatus**	**2 HOURS**
To demonstrate the boiling phenomenon and to calculate the critical heat flux		
PRACTICAL NO.07	**Study of film wise and drop wise condensation**	**2 HOURS**
To study the phenomenon of film wise and drop wise condensation		
PRACTICAL NO.08	**Stefan Boltzmanns apparatus**	**2 HOURS**
To determine the value of Stefan Boltzmanns constant for black bodies		
PRACTICAL NO.09	**Heat transfer in agitated vessel**	**2 HOURS**
To study the effect of flow rate of heating/cooling media, temperature and agitation speed on calculation of overall heat transfer coefficient for heating/cooling in agitated vessel		
PRACTICAL NO.10	**Plate type heat exchanger**	**2 HOURS**
To determine Logarithmic Mean Temperature Difference (LMTD), overall heat transfer coefficient and effectiveness of plate type heat exchanger		
PRACTICAL NO.11	**Shell and tube heat exchanger**	**2 HOURS**
To determine Logarithmic Mean Temperature Difference (LMTD), overall heat transfer coefficient and effectiveness of shell and tube heat exchanger for co-current and counter current flow.		
PRACTICAL NO.12	**Transient heat conduction**	**2 HOURS**
To calculate Biot and Fourier numbers and the determination of heat transfer coefficient		

TEXT BOOKS

1. McCabe W.L, Smith J.C, Unit Operations in Chemical Engineering, McGraw-Hill, 7th Edition,2014. ISBN : 9339213238.
2. Sukhatme S.P, A Text Book on Heat Transfer, Universities Press,4thEdition, 2005. ISBN : 8173715440.

REFERENCE BOOKS

1. Coulson J.M, Richardson J.F, Chemical Engineering, Vol.1, Butterworth and Heinemann Publishers, 6th Edition, 1970. ISBN : 9780750644440.
2. Binay K.Dutta, Heat Transfer Principles and Applications, Prentice Hall of India, 2001. ISBN: 8120316258.
3. Kern D.Q, Process Heat Transfer , McGraw Hill Revised edition, 1st Edition, 1999. ISBN 007085353.
4. Holman J.P, Heat Transfer, McGraw Hill,9th Edition, 2008. ISBN : 0070634513.
5. Yunus A. Cengel, Heat and Mass Transfer, Tata McGraw Hill Publications, New Delhi, 3rd Edition, (2007). ISBN 007245893.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Advanced Chemistry
	COURSE CODE	CH232
	COURSE CREDITS	4
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH222: Inorganic and Analytical Chemistry

COURSE OBJECTIVES :

CH232.CEO.1: Study the kinetics of various possible chemical reactions and the factors that influences them.
CH232.CEO.2: Impart the basic concepts of physical and analytical chemistry.
CH232.CEO.3: Develop understanding about concepts on mechanisms of organic reactions.
CH232.CEO.4: Study the different optical, analytical and thermal characterization methods.

COURSE OUTCOMES :

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

CH232.CO.1: Predict the rates of given chemical and photochemical processes.
CH232.CO.2: Recognize how the MSDS improves your access to vital safety, health, and environmental information about chemicals used in the workplace.
CH232.CO.3: Apply adsorption & catalysis technique for purification & unit processes.
CH232.CO.4: Predict the mechanism of given organic reaction.
CH232.CO.5: Interpret spectral data and identify unknown compounds.
CH232.CO.6: Interpret the thermograms, analyze and present the result of the measurements.

THEORY COURSE CONTENT		
UNIT 1	**KInetics and Photochemistry**	**7 HOURS**
A) Kinetics: Rate of reaction, rate constant, order of reaction, kinetics of first and second order reactions, numerical on above, Activated complex theory of reaction rates, kinetics of complex reactions, Unimolecular reactions. B) Introduction and importance, Stark-Einstein law, photochemical rate law, examples of photochemical reactions kinetics of i) H2, Cl2 reaction ii) dimerization of anthracene.		
UNIT 2	**Material Safety Data Sheet and Phase Rule**	**7 HOURS**
A) Understanding the Material Safety Data Sheet, first aid measures, fire and fire fighting, handling and storage of chemicals and good safety practices. B) Phase Rule: Gibbs Phase rule & terms involved it with examples. Phase rule for Chemical reaction equilibrium. One component system- water. Reduced phase rule. Applications & limitations of phase rule.		
UNIT 3	**Adsorption and Catalysis**	**7 HOURS**
Adsorption: Introduction to Freundlich and Langmuir theories of adsorption, adsorption from solution, B.E.T. Theory of adsorption of gases, activation energy, numerical on above. Catalysis: characteristics, types, adsorption theory of catalysis, promoters, poisons, industrial applications of catalysts; acid base catalysis Biological catalysis- Kinetics of enzyme catalyzed reaction. Zeolites- structure, properties applications as catalyst for various reactions		
UNIT 4	**Reaction Mechanisms**	**7 HOURS**
Substitution at saturated carbon (SN1, SN2) (Self Study) - mechanism, kinetics, stereochemistry, factors favoring it. Electrophilic aromatic substitution in benzene and mono substituted benzenes, activating and deactivating groups, nitration, Friedel-Craft reactions, sulphonation, and diazotization. Nucleophilic substitution on carbonyl carbon. Addition of HX on C=C, 1, 2-Eliminations- E1 mechanism, E2, (Saytzeff, Hoffman products), factors favoring it. Rearrangement reactions.		
UNIT 5	**Advanced Spectroscopy**	**7 HOURS**
Diamagnetism and paramagnetism, nuclear spin, NMR spectroscopy, chemical shift, nuclear spin - spin coupling, Interpretation of NMR spectra. Introduction to mass spectroscopy.		
UNIT 6	**Atomic Spectometric and Thermal Methods**	**7 HOURS**
Atomic Absorption Spectrophotometry & SEM Principles, Instrumentation & applications Thermal Methods: Thermogravimetric Analysis (TGA) Differential thermal Analysis (DTA), Differential Scanning Calorimetry (DSC).		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Rate constant of first order reaction of acid catalyzed hydrolysis of ester		
PRACTICAL NO.02		**2 HOURS**
Adsorption of acetic acid on charcoal to verify Freundlich isotherm		
PRACTICAL NO.03		**2 HOURS**
Purification of organic compounds by crystallization and sublimation (one each)		
PRACTICAL NO.04		**2 HOURS**
Preparation of m-dinitro benzene from nitrobenzene, crystallization and purity checking by TLC		
PRACTICAL NO.05		**2 HOURS**
Determination of the percent purity of sodium bicarbonate (NaHCO3) by gravimetry		
PRACTICAL NO.06		**2 HOURS**
Interpretation of NMR Spectrum		
PRACTICAL NO.07		**2 HOURS**
To determine the energy of activation of reaction between K2S2O8 & KI		
PRACTICAL NO.08		**2 HOURS**
Identification of given organic compound (with maximum one functional group) by systematic analysis		
PRACTICAL NO.09		**2 HOURS**
Identification of given organic compound (with maximum one functional group) by systematic analysis		

TEXT BOOKS

1. Mehta & Mehta, Organic Chemistry, PHI Learning Pvt. Ltd., 2005, ISBN : 9788120324411.
2. Puri, Sharma & Pathania, Inorganic Chemistry, Shoban Lal Nagin Chand & Co. ISBN : 9788188646999.
3. Gary D. Christian, Analytical Chemistry, 6th Edition, John Wiley and Sons Inc. ISBN : 9780471214724.
4. Soni P. L. Physical Chemistry, S. Chand & Company, ISBN 9788180545870.
5. Br.Puri, Lr Sharma, Madan S Pathania, Principles of Physical Chemistry, Vishal Publishing Co. ISBN-13: 9789382956785.

REFERENCE BOOKS

1. Finar I.L, Organic chemistry, Vol. I and II, ELBS Longman Limited.ISBN :9788177585421.
2. Lee J.D, Inorganic chemistry, 5th Edition, (ELBS) Chapman & Hall.ISBN :9780412402906.
3. Cotton, Wilkinson, Basic Inorganic chemistry, 3rd Edition, Wiley India Pvt. Ltd. ISBN: 9780471505327.
4. Skoog and West, Fundamentals of Analytical Chemistry, 8th Edition, Thomson Asia, ISBN: 9780495558286.
5. P. S. Kalsi, Spectroscopy of Organic compounds New age international, ISBN:8122415431.
6. Sykes Peter, Reaction mechanism, 6th Edition, Orient Longman Private Ltd.ISBN: 9780582266445.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Mass Transfer
	COURSE CODE	CH233
	COURSE CREDITS	4
RELEASE DATE : 01/07/2020	**REVISION NO**	0.1

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH223: Momentum Transfer

COURSE OBJECTIVES :

CH233.CEO.1: Understand the concept and use of separation processes.
CH233.CEO.2: Learn the basics of diffusion and the empirical laws that govern diffusion.
CH233.CEO.3: Understand the analogies between momentum, mass and heat transfer.
CH233.CEO.4: Understand the concept and importance of mass transfer coefficient.
CH233.CEO.5: Understand the mechanism of all simultaneous heat and mass transfer operations.
CH233.CEO.6: Understand the uses and design concept of separation processes.

COURSE OUTCOMES :

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

CH233.CO.1: Calculate the molar flux for different systems.
CH233.CO.2: Determine the individual and overall transfer coefficients.
CH233.CO.3: Use the Psychrometric chart for humidification operations.
CH233.CO.4: Analyze the drying rate of the given material.
CH233.CO.5: Develop the equilibrium data for crystallization operation.
CH233.CO.6: Design equipment for various mass transfer operations.

THEORY COURSE CONTENT		
UNIT 1	**Diffusion**	**7 HOURS**
Introduction to mass transfer operations, their uses and classification. Molecular and eddy diffusion, Ficks law, measurement and calculation of diffusivity, diffusion in multi-component gaseous mixtures, diffusion in solids and its applications, steady state diffusion under stagnant and laminar flow conditions.		
UNIT 2	**Interphase Mass transfer**	**7 HOURS**
Concept of mass transfer co-efficient, interphase and overall mass transfer coefficient in binary and multi-component systems, mass transfer under laminar and turbulent flow, theories of mass transfer and their applications, boundary layer, correlation of mass transfer co-efficient, analogies between momentum, heat and mass transfer, Jh & Jd factor.		
UNIT 3	**Humidification**	**7 HOURS**
Basic concepts & definitions, psychrometric chart, wet-bulb temperature and Lewis relation, methods of humidification and dehumidification, design calculation, cooling towers principle and operation, equipment.		
UNIT 4	**Drying**	**7 HOURS**
Principles of drying and mechanism of drying, drying characteristics, classification of dryers, working principles of dryers, design and performance of batch and continuous dryers, estimation of drying rates.		
UNIT 5	**Crystallization**	**7 HOURS**
Theory of crystallization, Miers theory of supersaturation, factors governing nucleation and crystal growth, growth coefficient, mass and energy balance, batch and continuous crystallizers, industrial crystallizer.		
UNIT 6	**Evaporation**	**8 HOURS**
Evaporation, single and multiple effect evaporation, types of evaporators, design calculation for single and multiple effect evaporators.		

PRACTICAL		
PRACTICAL NO.01	**Solid Liquid Diffusion**	**2 HOURS**
Estimation of the diffusion coefficient for solid liquid diffusion using benzoic acid in water system.		
PRACTICAL NO.02	**Molecular Diffusion in Liquids**	**2 HOURS**
Estimation of the mass transfer coefficient for liquid liquid diffusion (Molecular).		
PRACTICAL NO.03	**Eddy diffusion in Liquids**	**2 HOURS**
Estimation of the mass transfer coefficient for liquid liquid diffusion (Eddy).		
PRACTICAL NO.04	**Liquid Air Diffusion**	**2 HOURS**
Estimation of the diffusion coefficient for liquid diffusion in air.		
PRACTICAL NO.05	**Psychrometric chart**	**2 HOURS**
Estimation of properties of air water system using Psychrometric chart.		
PRACTICAL NO.06	**Tray Dryer**	**2 HOURS**
Design of tray dryer for the given system (Sand / Saw dust).		
PRACTICAL NO.07	**Crystallizer**	**2 HOURS**
Design of crystallizer for the given capacity.		
PRACTICAL NO.08	**Equilibrium data for Crystallizer**	**2 HOURS**
Batch studies on solubility and yield of crystallizer.		
PRACTICAL NO.09	**Fluidized Bed Dryer**	**2 HOURS**
Studies on fluidized bed dryer.		
PRACTICAL NO.10	**Humidifier**	**2 HOURS**
Estimation of mass transfer flux for the humidification column.		
PRACTICAL NO.11	**Single Effect Evaporator**	**2 HOURS**
Design of single effect evaporator for the given system.		
PRACTICAL NO.12	**Cooling Tower**	**2 HOURS**
Studies on Cooling tower.		

TEXT BOOKS

1. Warren L McCabe, Julian C Smith and Peter Harriott, Unit Operations of Chemical Engineering, McGraw Hill International Edition, 6th Edition, New York 2001, ISBN 9780070448285.
2. Robert E Treybal, Mass Transfer Operations, McGraw Hill International Edition, 3rd Edition, Singapore, 1980, ISBN 9780070651760.
3. Geankoplis C.J, Transport Processes and Unit Operations, Prentice Hall Inc., 4th Edition, New Jersey, 2003, ISBN 013101367X.

REFERENCE BOOKS

1. Coulson J.M, Richardson J.F. Backhurst J.R. and. Harker J.M, Chemical Engineering, Vol. 1 & 2, Butter worth Heinemann, 6th Edition, 1999, ISBN 9780080494227.
2. Foust A.S, Principles of Unit Operations, John Wiley, ISBN 9780471268963.
3. Seader J.D & Henley E.J, Separation Process Principles, John Wiley, 2nd Edition, 2006, ISBN 9780471586265.
4. Welty J.R, Wicks C.E. & Wilson R.E, Fundamentals of Momentum, Heat & Mass Transfer, John Wiley, ISBN 9780471874973.
5. King C.J, Separation Processes, Tata McGraw Hill, 2nd Edition, 1980, ISBN 9780070993860.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Professional Skills
	COURSE CODE	HP 202
	COURSE CREDITS	2
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
NIL	4	NIL	NIL	NIL	50	25	75

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

HP202.CEO.1: To increase students confidence during everyday communication.

HP202.CEO.2: To increase impact of students communication during presentations and public speaking.

HP202.CEO.3: To develop Leadership qualities among students.

COURSE OUTCOMES :

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

HP202.CO.1: Express themselves effectively in routine and real-world interactions through verbal and written communication.

HP202.CO.2: Show Confident Public Speaking skills.

HP202.CO.3: To showcase leadership qualities during tough tasks, make decisions and actions effectively within time.

TUTORIALS: (SECTION A)		
TUTORIAL NO.01	**Role Plays and Picture Description**	**4 HOURS**
It helps students to sharpen their extempore skills with effective articulation and logical sequencing of content.		
TUTORIAL NO.02	**Creative Writing Skills and Presentation Skills**	**8 HOURS**
It aims at evolving effective writing skills and presentation skills.		
TUTORIAL NO.03	**Voice Modulation and Audio - Video Listening and Debate**	**8 HOURS**
To enhance listening skills and to teach the students the basic components of voice modulations and helping them practice it. It helps overcome stage fear and learn audience engagement		
TUTORIAL NO.04	**Leadership**	**6 HOURS**
Leadership qualities helps person to lead a team in achieving the set vision. It helps in planning to execute it, utilizing resources and motivating people involved in it.		
TUTORIAL NO.05	**Decision Making**	**4 HOURS**
It helps to make necessary courageous and difficult decisions and carry them into action.		
TUTORIAL NO.06	**Time Management**	**6 HOURS**
It helps organizing and planning how to divide valuable time between specific activities and prioritizing activities.		
SECTION B:	**Verbal, Reasoning and Aptitude Training through BtechGuru**	**12 HOURS**

TEXT BOOK

1. J.K.Gangal, A Practical Course in Effective English Speaking Skills, Prentice Hall India Learning Private Limited (2012), ISBN-10: 8120345843.
2. Jean Yates, Practice Makes Perfect: English Conversation, Premium Second Edition, McGraw-Hill Education; 2 edition, ISBN-10: 1259643271.
3. Brian Stacy, Speak to Win. How to Present with Power in Any Situation, AMACOM; Special ed. edition (16 February 2008). ISBN-10: 0814401570.
4. Simon Wootton and Terry Horney, Strategic Thinking A Nine Step Approach to Strategy and Leadership for Managers and Marketer, ISBN13: 9780749460778.
5. Lorin Woolfe, The Bible on Leadership: From Moses to Matthew – Management Lessons for Contemporary Leaders, ISBN-10 : 0814439438; ISBN-13 : 978-0814439432.

REFERENCE BOOK

1. J.K.Gangal, A Practical Course in Effective English Speaking Skills, Prentice Hall India Learning Private Limited (2012), ISBN-10: 8120345843.
2. Jean Yates, Practice Makes Perfect: English Conversation, Premium Second Edition, McGraw-Hill Education; 2 edition, ISBN-10: 1259643271.
3. Brian Stacy, Speak to Win. How to Present with Power in Any Situation, AMACOM; Special ed. edition (16 February 2008). ISBN-10: 0814401570.
4. Garr Reynolds, Presentation Zen: Simple Ideas on Presentation Design and Delivery (Voices That Matter) , New Riders; 2 edition (8 December 2011), ISBN-10: 0321811984.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF ELECTRICAL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Digital Prototyping
	COURSE CODE	ET224
	COURSE CREDITS	2
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

ET224.CEO.1: To learn about materiality and techniques.
ET224.CEO.2: To justify the product development cycle through prototype project.
ET224.CEO.3: To inculcate implementation of skills by proper budget planning with effective troubleshooting and practices in aesthetics & ergonomics.
ET224.CEO.4: To 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,

ET224.CO.1: Consolidate the techniques, skills and modern engineering tools.
ET224.CO.2: Apply acquired skills to the construction of a prototype project.
ET224.CO.3: Develop a prototype project by performing tasks in team.
ET224.CO.4: Demonstrate the work carried out in a team.

PRACTICAL

Course Introduction:

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.

Students will complete four modules in rotational manner,

1. Hardware Prototyping (HP)
2. Software Prototyping(SP)

In the module hardware prototyping students will develop a prototype of electronic product. Student will be acquiring different skills in electronics like Soldering, Wiring and PCB Design using Electronic Design Automated tools, Assembly of electronic product, Testing and troubleshooting, requirement Analysis , Product concept development in electronic product design.

On the other hand in software prototyping students will learn Software development life cycle (SDLC) concepts, AEIOU framework, UML diagrams, Requirement analysis, data flow diagrams, creating high fidelity prototypes, Testing and Analysis etc.

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.

Marks of two modules at a time will be averaged in one semester and if student secures passing marks (passing grade) after averaging; then the required credits of the course will be earned.

For Digital Prototyping, Semester - III

Module	**Programs**
a) Hardware Prototyping (HP)	SY BTECH Electronics Engineering, Electronics & Telecommunication Engineering, Computer Engineering, Information technology
b) Software Prototyping (SP)	

For Digital Prototyping, Semester - IV

Module	**Programs**
a) Hardware Prototyping (HP)	SY BTECH Civil Engineering, Mechanical Engineering, Chemical Engineering
b) Software Prototyping (SP)	

MODULE: 1/2	Hardware Prototyping (HP)	28 HOURS

PRACTICAL:

PRACTICAL NO. 01	Introduction to design and construction of electronic prototyping	02 HOURS

1. Gain familiarity with basic product design stages; Conceptualization, Detailed Design and Implementation. Form a group of students. (04 max)
2. Acquire concepts of basic processes in electronic prototyping. Develop Concept Description Sheet (CDS) for product to be designed.
3. Perform Brainstorming and develop a simple electronic product idea based on given pre-declared theme in given time span. Hence draw Physical and Mechanical Drawing.
4. Perform Customer Survey and Competitor Analysis
5. Develop Specifications and Make requirement analysis. Hence develop Bill of Material.
6. Develop a plan for construction of electronic proto from a concept.

PRACTICAL NO. 02	Basic electronic prototyping skills	02 HOURS

1. Soldering
   - Demonstrate structure of solder wire, soldering temperature, soldering station and gun.
   - Highlight Industrial safety norms, use of lead free solder, extractor fan etc.
   - Use of flux, desoldering gun, desoldering techniques, removing components/wires.
   - Fix Solder defects and inspect quality of solder joints.
2. Wiring
   - Cleaning, stripping and tinning the wires.
   - Connections and protections for wires.

PRACTICAL NO. 03	PCB design using basic Electronic Design Automation (EDA)tools	06 HOURS

1. Gain familiarity with PCB Design software.
2. Draw schematics for PCB design.
3. Make PCB layout as per circuit diagram. Learn PCB design standards.
4. Export PCB files like gerber (.gbr), .pdf etc.

PRACTICAL NO. 04	PCB fabrication	06 HOURS

1. Develop negative imprints of top and bottom sides and expose to PCB.
2. Perform etching process for PCB.
3. Perform cleaning and shearing for required size.
4. Check continuity of tracks.
5. Use drilling machine to make drills.

PRACTICAL NO. 05	Assembly and testing of electronic proto	08 HOURS

1. Make assembly of electronic prototype
2. Insert components, perform lead cutting with standard clearance.
3. Review mechanical fitment of PCB with component insertion.
4. Solder components and make wiring.
5. Test prototype for electrical functionality, to perform rework if required.
6. Assemble PCB with mechanical fitments and assemblies.
7. Analyze performance and compare with specifications.
8. Develop Customer feedback sheet and Take feedback from Customers.
9. Make Customer feedback Analysis based on ratings.

PRACTICAL NO. 06	Final project presentation	04 HOURS

1. Demonstrate an electronic prototype in a team.
2. Write a report on implementation of prototype. (10-15 pages max)
3. Present prototype implementation in a team by Power Point presentation.
4. Enumerate proposed specifications of electronic prototype.
5. Highlight financial aspects including proposed cost and bill of material.
6. Present Customer feedback analysis.

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.

MODULE: 2/2	**Software Prototyping (SP)**	**28 HOURS**
PRACTICAL		
PRACTICAL NO. 01	**Introduction to software engineering**	**04 HOURS**
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		
PRACTICAL NO. 02	**Requirement analysis**	**04 HOURS**
Find the requirement specification of given problem statement and formulate the feasible solution.		
PRACTICAL NO. 03	**Design UML Diagrams for given problem statement**	**06 HOURS**
Students have to work in group on Project Development canvas and then design following, 1. Creation of data flow diagram 2. Creation of block diagram 3. Design a activity diagram		

PRACTICAL NO. 04	Design analysis	02 HOURS
Create High Fidelity Prototype		
PRACTICAL NO. 05	**Prototype Implementation**	**06 HOURS**
Use of prototype development tools such as Proto.io, Invision		
PRACTICAL NO. 06	**Presentation**	**04 HOURS**
Each group will be given 10 min to present their work.		

REFERENCE BOOK

1. Software Engineering A practitioners Approach, Roger S, Pressman, 7th Edition, ISBN: 9780073375977
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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Minor Project-Implementation
	COURSE CODE	ME240
	COURSE CREDITS	1
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

ME240.CEO.1: To understand the Intellectual property rights, trademarks, copyrights etc

ME240.CEO.2: To make the students more effective problem solvers with broader perspective of thinking.

ME240.CEO.3: To engage them in creative thinking to improve the project performance using recent trends.

ME240.CEO.4: To design working model for the solution of the problem.

ME240.CEO.5: To Evaluate the model built for its correctness, reliability and sustainability.

ME240.CEO.6: To be more self efficient to solve problem in real time design environment.

COURSE OUTCOMES :

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

ME240.CO.1: Select appropriate method for making of solution.

ME240.CO.2: Compare various engineering tools/technique to develop solution.

ME240.CO.3: Justify the selected method/tools opted for making of solution.

ME240.CO.4: Develop tangible solution to defined problem.

ME240.CO.5: Test the developed solution.

ME240.CO.6: Document solution in the form of Project report / IPR drafts.

COURSE ABSTRACT

It is a need of the time to pay attention to the societal needs by an engineering graduate to solve some of the real life societal problems by providing affordable technological solutions. The concept of the 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. This will help students to understand the process of product/project development, best practices and encourage their creativity to solve real life problems. The students will learn effective team building, designing, budgeting, planning, engineering skills and processes, safety norms and standards while developing the application/ product. The students will be able to understand importance of documentation and professional ethics.

Guidelines

1. Every student shall undertake the Minor Project in semester III and IV.
2. Every student shall work on an approved project, a group of 03/04 students (maximum) shall be allotted for each minor project.
3. The group members may be from different programme to support the interdisciplinary functioning.
4. The students have to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
5. Collect the sufficient data and survey to establish the criticality of the problem to be solved.
6. Apply various tools for project planning and design.
7. Critically analyze various solutions/techniques to solve real world problems.
8. Select and justify one of the solutions identified based on the feasibility, affordability and ease of use.
9. Learn and apply standards of engineering ethics and professional behavior.
10. Adherence to the highest principles of ethics, conduct and practices.

TIMELINE

1. IPR Activity on Earlier allocated Group : 2 Weeks (1^{st} ,2^{nd} week)
2. Presentation of Project Review -1- Finalizing title with feasibility study and approval: 2 Weeks (4^{th}, 5^{th} week)
3. Presentation of Project Review -2 Analysis and Design of Project: 2 weeks (9^{th}, 10^{th} week)
4. Preparation of Project Progress Report I (week 11^{th} and 12^{th}) Project Phase-II
5. Project Review III (10 marks) (week 11^{th})
6. Evaluation by external examiner (End Semester by 12^{th}, 13^{th} week)

Demonstration and Presentation (50 Marks)

1. **Review 1 (Project Implementation) (10 marks)**
2. **Review 2 (Project Demostration) (10 marks)**
3. **Project Activities (10 Marks)**
    - Quiz on IPR (5 marks)
    - Patent Drafting (5 marks)
4. **Review 3 (Project Documentation) (10 marks)**
5. **Final Demonstration and Presentation (10 marks)**

WEEK NO	TASK TO BE DONE BY MENTOR	ACTIVITY TO BE PERFORMED BY STUDENTS GROUP	EXPECTED OUTCOME
Week 1	Introduction to IPR (Patent & Right) (30 min) Videos on Patent: (30 min)	Student will attempt Quiz-I IPR after the lecture Graded Activity 5marks Template I	Student will learn the patents and how to search patent
Week 2	How to check patent through CDAC online portal.	Student will do prior art search for their project, and try to generate patent Abstract as per the (Template- II)	Submission of Patent Abstract as per the prescribed Template.
Week-3	Design, Architectural overview /feasibility analysis of the project, Recent trends available to improve the performance.	Discussion on system architecture/ design method/ feasibility of project idea.	Student will implement the best feasible method to generate prototype
Week-4	NIL	Review I -Presentation	Student will present progress done in project prototype building.
Week-5	Searching of Patents, Drafting of Patents , Filing of Patents , types of patent Application, Patent Documents. Expert lecture on above topic.	Final Drafting of complete patent document (05 marks) Graded Activity	Student will understand the basics of drafting patents, important of filling patent Submission in LMS
Week-6	Presentation, discussion and doubt clearing based on • Working on Algorithms / Design • Working on Analysis • Developing Prototype / Programming/ Circuits etc	As per department / school	Student will learn to prevent design flaws.

WEEK NO	TASK TO BE DONE BY MENTOR	ACTIVITY TO BE PERFORMED BY STUDENTS GROUP	EXPECTED OUTCOME
Week-7	Presentation, discussion and doubt clearing based on • Working on Algorithms/Design • Working on Analysis • Testing of Prototype/ Code/ Circuits of project	As per department / school	Student will analyze for project outcome
Week-8	NIL	Review-II (10 Marks)	Student will work for performance improvement if project not working satisfactorily.
Week-9	Regarding Final PPT For Project Faculty himself gives a presentation based on how to make effective presentation on research topics.	(GRADED ACTIVITY) (5 marks) Student will submit the Draft PPT through LMS at the end of Week-10	Student will learn to generate PPT covering all final outcomes of the project.
Week-10	Regarding Final report Generation For Project Faculty himself gives a presentation based on how to make effective project report should explain all guidelines to be followed while preparing report	(GRADED ACTIVITY)(5 marks) Student will submit the Draft Project report through LMS at the end of Week-10	Student report are expected to have design Analysis, and the project should be expected to one year with the same guide
Week-11	NIL	Review-III (10 Marks)	Students are expected to prepare a detailed project report and Project PPT , they should also check for plagiarism.
Week-12	Final Project presentation and project report submission to the project coordinator. Faculty will review the student projects with external examiner	Presentation and demonstration of project.	Prototypes/Software and Final Project report

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2020 - 2021 (Rev. 2019)
SECOND YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Liberal Learning
	COURSE CODE	HP203
	COURSE CREDITS	AUDIT
RELEASE DATE : 01/07/2020	**REVISION NO**	1.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

HP203.CEO.1: To create awareness about joy of learning among students
HP203.CEO.2: To teach the skills necessary to be a lifelong learner
HP203.CEO.3: To provide students with broad knowledge of the wider worlds.
HP203.CEO.4: To develop a sense of social responsibility as well as strong and transferable intellectual and practical skills.
HP203.CEO.5: To inculcate intellectual, civic, and practical capacities in students.

COURSE OUTCOMES :

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

HP203.CO.1: Develop a skill in the domain of their interest.
HP203.CO.2: Demonstrate the skills learnt in the course.
HP203.CO.3: Apply the concepts learnt in real-life situations.

NOTE : Students may select any one of the following tracks

COURSE CONTENTS

Track 1	**Introduction to photography**	**12 HOURS**

Types of camera, Basic camera controls. Light & Lenses, Understanding the Exposure Triangle. Aperture, Shutter Speed, and ISO. Auto and manual focus, Depth of field Landscape & nature photography, Creative aspects.

Track 2	**Dance**	**12 HOURS**

Study and demonstration of various dance forms such as classical, Bollywood, street dance, ballroom dance and Contemporary.

Track 3	**Creative Writing**	**12 HOURS**

Introduction to Creative Writing-How, literary aspects, different genres, forms of writing and script writing, Short Story Writing. Blog Writing.

Track 4	**Guitar**	**12 HOURS**

Parts of guitar, Names of strings, Proper right hand techniques, Proper left hand techniques, Tuning Guitar, Tuning by Ear, Tuning to a keyboard

Introduction to guitar fret board & The Chromatic Scale- The Chromatic Scale, Fret board, How to read Guitar Tablature, Finger exercises, how to read Chord Blocks.

Track 5	**Art and Craft**	**12 HOURS**

Sketching & Drawing, Elements of Art, types of art forms, types of Painting, Craft, Wrap in scrap, Best out of waste, Paper craft, Cloth craft & Rangoli.

Track 6	**Robotics**	**12 HOURS**

Introduction to Robotics, Robotics Links and joints, Selection & types of sensors, Actuators.

Track 7	**Drama**	**12 HOURS**

Learning & practicing narrations, craft and art conceptualization as an effective presentation, Survey for identification of social and global issues as a concept in script writing, Sound and illumination measures.

Understanding the audition for various sections like drama & film.

Illustrating the dialog delivery, expressions, volume, pitch in the dialog, Expression through photography and editing skill with an expertise in handling cameras, microphone, effective management skill enabling the justification through foundation till representation.

Track 8	**Yoga and Meditation**	**12 HOURS**

Concept of mind, Consciousness. Concentration techniques, Breathing exercises, Visualizations, Walking meditations. Simple yoga, Meditation and prayer, Asana and its types , Pranayama, its types and principles.

Track 9	**Automotive Skills**	**12 HOURS**

Introduction to Automotive system, Brake system, Power train of automotive, Suspension system, Computer Aided Engineering, Manufacturing and safety, Assembly and finishing.

Track 10	**Empathy & Compassion**	**12 HOURS**

Importance of Empathy, Role of empathy and compassion for engineers, Empathy activities, Skepticism About the Self, Free Will and the Situation, Recognizing emotions reading body language, improving listening skills, mindful self compassion, Compassionate Leadership,Origins of Morality, joy of giving, social responsibility, exercising social services.

Track 11	**Singing**	**12 HOURS**

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

Track 12	**Chess**	**12 HOURS**

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

Track 13	**RC Plane**	**12 HOURS**

Introduction to RC planes, study with categorization of planes and study of control forces on RC plane. Study of control surfaces. Study of airfoil, Studying the concepts of take-off, cruising, landing and motions during flight. Study of graphs. Study on factors affecting the flight of plane. Control and propulsion system of RC aircraft. Introduction and making of Electrical glider.

Track 14	Drone Making	12 HOURS

Three thumb rules, Basic of FAA, Combination of electronics, Frame design , Motor stator reading and dimension, Basic of electronics, Introduction to Drones, Fundamental of Flight, Airframes and Electric Motors, ESC and flight controller, Receivers And Transmitter, Battery and chargers, Basic building Tutorial with working on software(Betaflight), FPV and LOS Simulations, Working on development of Betaflight.

NOTE : More tracks will be added as per demand of the students

MIT | Academy of Engineering

MIT ACADEMY OF ENGINEERING, ALANDI

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Curriculum

For

Third Year

Bachelor of Technology in Chemical Engineering

2019-2023

(With Effect from Academic Year: 2021-2022)

MIT | Academy of Engineering Autonomous Institute Affiliated to SPPU	COURSE STRUCTURE (2019 - 2023)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2021-2022
THIRD YEAR BACHLEOR OF TECHNOLOGY IN CHEMICAL ENGINEERING	RELEASE DATE	:	01/07/2021
	REVISION NO.	:	1.0

SEMESTER: V

INTERNSHIP (CH300)

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
DC08	CH341	Chemical Engineering Operations	3	2	-	35	35	30	50	0	150	4
DC09	CH342	Separation Process	3	2	-	35	35	30	50	0	150	4
DC10	CH343	Chemical Reaction Engineering	3	2	-	35	35	30	50	0	150	4
OE01	CH351 / CH352	Process Engineering / Energy Technology	3	2	-	35	35	30	50	0	150	4
HSS5	HP304	Project Management	2	0	-	0	50	25	0	0	75	2
SDP7	CH344	Skill Development Lab (CFD)	0	4	-	0	0	25	50	0	75	2
SDP8	CH345	Project Design	0	4	-	0	0	25	0	50	75	2
TOTAL			**14**	**16**	**0**	**140**	**190**	**195**	**250**	**50**	**825**	**22**

SEMESTER: VI

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
DC11	CH361	Process Dynamics and Control	3	2	-	35	35	30	50	0	150	4
DC12	CH362	Chemical Equipment Design I	3	2	-	35	35	30	50	0	150	4
DC13	CH363	Chemical Process Technology	3	0	-	35	35	30	0	0	100	3
OE02	CH371 / CH372	Process Modelling and Simulation / Energy Modeling and Simulation	3	2	-	35	35	30	50	0	150	4
HSS6	HP305	Employability and Career Development	0	4	-	0	0	25	0	50	75	2
SDP9	CH364	Skill Development Lab (ASPEN ONE)	0	4	-	0	0	25	50	0	75	2
SDP10	CH365	Project Implementation	0	4	-	0	0	25	0	50	75	2
TOTAL			**12**	**18**	**0**	**140**	**140**	**195**	**200**	**100**	**775**	**21**

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Chemical Engineering Operations
	COURSE CODE	CH341
	COURSE CREDITS	4
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH223: Momentum Transfer, CH231: Heat Transfer

COURSE OBJECTIVES :

CH341.CEO.1: Understand solid storage and transportation systems.
CH341.CEO.2: Demonstrate parts of various equipments used in solid-fluid operation.
CH341.CEO.3: Calculate energy required for size reduction and for mixing operation.
CH341.CEO.4: Apply various mathematical equations for calculate pressure drop across systems.
CH341.CEO.5: Select proper impellers and mixer for given application
CH341.CEO.6: Select Proper equipments for solid-solid and solid- fluid separation

COURSE OUTCOMES :

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

CH341.CO.1: Explain parts of equipments used in Solid-solid, solid-fluid separation.
CH341.CO.2: Distinguish between various solid transportation equipments.
CH341.CO.3: Calculate power requirement for various equipments with laws.
CH341.CO.4: Classify size reduction, mixing and solid-fluid separation equipments.
CH341.CO.5: Calculate pressure drop across solid- fluid systems.
CH341.CO.6: Select appropriate equipments for solid-solid and solid-fluid separation.

THEORY COURSE CONTENT		
UNIT 1	**Particle Screening and size reduction**	**10 HOURS**
Particle size and shape, Mixtures of particles, Determination of particle size, Standard screen series, screen analysis, Screen effectiveness and capacity, Industrial screening equipments. Crushing efficiency, energy requirements calculations by using different crushing laws, Size reduction equipments: Primary crushers, secondary crushers, Intermediate & fine grinders, Ultra fine grinders, Cutting machines.		
UNIT 2	**Handling And Transport of Solids**	**6 HOURS**
Storage of solids, characteristics of Bulk solids. Conveyors: Working principles, Construction, Advantages, Disadvantages and design calculation of Screw conveyors, Belt Conveyors, Chain & Flight conveyors, Bucket elevators, Pneumatic conveyors. Introduction to two phase flow and slurry flow pumps.		
UNIT 3	**Mixing and Agitation**	**6 HOURS**
Necessity of mixing & agitation in chemical industries, Types of Impellers & propellers, Different flow patterns in mixing, Calculation of power requirement of mixing equipment, Mixing equipment of pastes & viscous material, Solid Solid Mixing, segregation mechanisms for solid mixture, mixing mechanisms for mixing solids, Agitator selection		
UNIT 4	**Fluidization**	**4 HOURS**
Flow through packed beds (Kozeny-Carman and Erguns Equation), characteristics of fluidized systems, minimum fluidization velocity, Types of fluidization (homogenous and bubbling fluidization) spouted beds and fixed bed.		
UNIT 5	**Filtration**	**7 HOURS**
Filter media and filter aids, classification of filtration, pressure drop through filter cake, filter medium resistance, specific cake resistance, Continuous Filtration, Washing and dewatering of filter cakes, Centrifugal filtration.		
UNIT 6	**Fluid Solid systems**	**10 HOURS**
A: Liquid Solid Separation Gravity settling method: Terminal velocity, Stokes law and Newtons law, free settling, sink and float method, differential settling. Sedimentation and thickening: Batch sedimentation, equipments for sedimentation, Kynch theory of sedimentation, calculation of area and depth of continuous thickeners, batch thickeners, and continuous thickeners. B: Gas Solid Separation Different types of separation efficiency (Target efficiency, grade efficiency, Total efficiency of separation), Gas-cyclone, Bag house filter, Electrostatic Precipitator, Venturi scrubber.		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Jaw Crusher		
PRACTICAL NO.02		**2 HOURS**
Batch Ball Mill		
PRACTICAL NO.03		**2 HOURS**
Trommel		
PRACTICAL NO.04		**2 HOURS**
Power Consumption in Agitated Vessels		
PRACTICAL NO.05		**2 HOURS**
Plate and Frame Filter Press		
PRACTICAL NO.06		**2 HOURS**
Vacuum Leaf Filter		
PRACTICAL NO.07		**2 HOURS**
Cyclone Separator		
PRACTICAL NO.08		**2 HOURS**
Simulation of Cyclone Separator		
PRACTICAL NO.09		**2 HOURS**
Simulation Screening of Solid		
PRACTICAL NO.10		**2 HOURS**
Simulation of Filtration		

TEXT BOOKS

1. McCabe W. L. and Smith J.C. Unit Operations in Chemical Engineering, 5th Edition, McGraw Hill Publications, 1993, ISBN 007448442.
2. Badger W. L and Banchero J.T. Introduction to Chemical Engineering, McGraw Hill Publications, ISBN 0070029954.
3. George G. Brown, Unit operations, CBS publishers and distributors, 2005, ISBN 9788123910994.

REFERENCE BOOKS

1. Coulson J.M. and Richardson J.F., Chemical Engineering, Vol. 2, Butterworth Heinemann Publishers, ISBN 9780750644457.
2. Foust A.S, Principles of Unit Operation, 2nd Edition, John Wiley and Sons, ISBN 0471047872.
3. Levy A, Kalman H, Handbook of conveying and handling of particulate solids, Elsevier Science, 2001, ISBN 0444502351.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Separation Process
	COURSE CODE	CH342
	COURSE CREDITS	4
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH233: Mass Transfer

COURSE OBJECTIVES :

CH342.CEO.1: Understand the concept of vapor-liquid equilibrium and distillation.
CH342.CEO.2: Learn the various separation processes used in chemical industry.
CH342.CEO.3: Understand the equilibrium data and its application in the design.
CH342.CEO.4: Understand the mechanism of absorption, extraction, leaching & adsorption.
CH342.CEO.5: Introduce advanced separation techniques.
CH342.CEO.6: Study the working and design concept of various separation processes.

COURSE OUTCOMES :

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

CH342.CO.1: Generate the vapor - liquid equilibrium data for the given system.
CH342.CO.2: Perform material balance for batch and continuous distillation.
CH342.CO.3: Calculate the mass transfer coefficient for the different system.
CH342.CO.4: Analyze the effectiveness of the given separation column.
CH342.CO.5: Perform material balance calculations for different types of extraction units.
CH342.CO.6: Design equipment for various separation process.

THEORY COURSE CONTENT		
UNIT 1	**Distillation**	**8 HOURS**
Distillation principle, vapor liquid equilibria, Raoults law and deviations from ideality, relative volatility, methods of distillation, batch, continuous, flash, steam, vacuum, azeotropic, extractive and molecular distillation, reactive distillation.		
UNIT 2	**Design of Distillation Column**	**8 HOURS**
Continuous rectification, reflux, minimum and optimum reflux, number of ideal stages by McCabe Thiele method, Ponchon - Savorit method, Fenskes equation, Fenske Underwood equation, introduction to multi-component distillation.		
UNIT 3	**Absorption**	**8 HOURS**
Equilibrium and operating line concept in absorption calculations, absorption and stripping factors, calculation of NTU, HTU, number of stages, packed and plate type absorbers, absorption with chemical reaction, HETP, operating characteristics of stage wise and differential contactors.		
UNIT 4	**Liquid Liquid Extraction / Leaching**	**8 HOURS**
Liquid - liquid extraction, ternary liquid equilibria, stage wise contact equipment, calculations for batch and continuous extractors, calculation of number of stages. solid liquid equilibrium, equipment, batch and continuous type, calculation of number of stages.		
UNIT 5	**Adsorption**	**12 HOURS**
Types of adsorption, nature of adsorption, theories of adsorption, adsorption isotherms, operation of adsorption columns, introduction to pressure swing adsorption (PSA), and temperature swing adsorption (TSA) batch and continuous operations, equipment.		
UNIT 6	**Advanced Separation Techniques**	**12 HOURS**
Recent advances in separation techniques, supercritical fluid extraction, Chromatography fundamentals, ion exchange, reactive distillation. Types of membrane separation processes, applications and advantages of membrane separation.		

PRACTICAL		
PRACTICAL NO.01	**Refractive Index Vs Composition**	**2 HOURS**
Estimation of the composition Vs Refractive Index for the given system		
PRACTICAL NO.02	**Simple Distillation**	**2 HOURS**
Simple Distillation to verify Rayleighs equation		
PRACTICAL NO.03	**Steam Distillation**	**2 HOURS**
Steam Distillation to find actual distillation temperature, thermal and vaporization efficiency		
PRACTICAL NO.04	**Vapour Liquid Equilibria**	**2 HOURS**
Estimation of VLE data for given system (Methanol Water) and determination of Van - Laar constants		
PRACTICAL NO.05	**Wetted Wall Column**	**2 HOURS**
Estimation of mass transfer coefficient in wetted wall column for air water system		
PRACTICAL NO.06	**Simple Leaching**	**2 HOURS**
Estimation of separation efficiency for single / multi stage leaching		
PRACTICAL NO.07	**Counter Current Leaching**	**2 HOURS**
Counter current leaching in 3 stages for the given system		
PRACTICAL NO.08	**LLE for extraction**	**2 HOURS**
Liquid - Liquid Equilibrium for the given system and plot the binodal curve		
PRACTICAL NO.09	**Plait Point Estimation**	**2 HOURS**
Identification of plait point for the given system		
PRACTICAL NO.10	**Adsorption**	**2 HOURS**
Batch adsorption studies and identification of Langmuir isotherm constants		
PRACTICAL NO.11	**Simulation of Distillation Column**	**2 HOURS**
Simulation studies of distillation column using Aspen One		
PRACTICAL NO.12	**Simulation of Absorption column**	**2 HOURS**
Simulation studies of absorption column using Aspen One		

TEXT BOOKS

1. Warren L McCabe, Julian C Smith and Peter Harriott, Unit Operations of Chemical Engineering, McGraw Hill International Edition, 6th Edition, New York 2001, ISBN 9780070448285.
2. Robert E Treybal, Mass Transfer Operations, McGraw Hill International Edition, 3rd Edition, Singapore, 1980, ISBN 9780070651760.
3. Geankoplis C.J, Transport Processes and Unit Operations, Prentice Hall Inc., 4th Edition, New Jersey, 2003, ISBN 013101367X.

REFERENCE BOOKS

1. Coulson J.M, Richardson J.F. Backhurst J.R. and. Harker J.M, Chemical Engineering, Vol. 1 & 2, Butter worth Heinemann, 6th Edition, 1999, ISBN 9780080494227.
2. Foust A.S, Principles of Unit Operations, John Wiley, ISBN 9780471268963.
3. Seader J.D & Henley E.J, Separation Process Principles, John Wiley, 2nd Edition, 2006, ISBN 9780471586265.
4. Welty J.R, Wicks C.E. & Wilson R.E, Fundamentals of Momentum, Heat & Mass Transfer, John Wiley, ISBN 9780471874973.
5. King C.J, Separation Processes, Tata McGraw Hill, 2nd Edition, 1980, ISBN 9780070993860.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Chemical Reaction Engineering
	COURSE CODE	CH343
	COURSE CREDITS	4
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH224: Chemical Engineering Thermodynamics; CH232: Advanced Chemistry

COURSE OBJECTIVES :

CH343.CEO.1: Learn about reaction kinetics for different types of reactions.
CH343.CEO.2: Solve problems involving mass and energy balance with reaction.
CH343.CEO.3: Design chemical reactors such as batch reactor, mixed reactor and plug flow reactor.
CH343.CEO.4: Determine reaction mechanism using experimental data.
CH343.CEO.5: Develop critical and creative thinking skills related to reaction engineering.

COURSE OUTCOMES :

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

CH343.CO.1: Identify different reaction types and mechanisms.
CH343.CO.2: Classify the various reactor types and their applications.
CH343.CO.3: Apply rate equations to determine the kinetic parameters of a reaction.
CH343.CO.4: Compare the behavior of different reaction order systems.
CH343.CO.5: Analyze the data obtained for different reactor systems.
CH343.CO.6: Design a reactor based on the reaction kinetic data.

THEORY COURSE CONTENT		
UNIT 1	**Interpretation of Batch Reactor Data**	**7 HOURS**
Constant volume and variable volume batch reactor, liquid phase and gas phase reactions, integral method and differential method of analysis, irreversible and reversible reactions, single and multiple reactions, elementary and non-elementary reactions rate equation, fractional conversion, zero order reactions, first order reactions, second order reactions, fractional order reactions, reactions in series, parallel reactions, homogeneous catalyzed reactions.		
UNIT 2	**Ideal Reactors and Non-idealities in Real Reactors**	**7 HOURS**
Introduction to flow reactors, constant density and changing density systems, ideal batch reactor, steady state mixed flow reactor, steady state plug flow reactor performance equation, space time & space velocity, size comparison of single reactors. Non-ideal flow, Residence Time Distribution (RTD), State of aggregation, Earliness of mixing, Exit age distribution, dispersion model, tanks-in-series model.		
UNIT 3	**Reactor Combinations and Multiple Reactions**	**7 HOURS**
Plug flow reactors in series/parallel, mixed flow reactors in series, reactors of different types in series, recycle reactor, parallel reactions, reactions in series, two step irreversible series-parallel reactions contacting patterns, selectivity, product distribution, instantaneous and overall fractional yield, operating conditions.		
UNIT 4	**Solid Catalyzed Reactions**	**10 HOURS**
Rate equation for solid catalyzed reaction, measures of reaction rates, pore diffusion resistance with surface kinetics, Thiele modulus, effectiveness factor, Wagner modulus, pore resistance limits, particles of different sizes, spherical and cylindrical particles, arbitrary reaction kinetics, performance equations for reactors containing catalyst particles, adiabatic packed bed reactor, slurry reactor.		
UNIT 5	**Fluid-Solid Reactions**	**6 HOURS**
Progressive conversion model (PCM), shrinking core model (SCM), spherical particles of changing and unchanging sizes, determination of rate controlling step gas film diffusion, ash layer diffusion, surface reaction, combination of resistances, mixture of particles of different sizes, fluidized bed reactor.		
UNIT 6	**Fluid-Fluid Reactions**	**5 HOURS**
Rate equation for mass transfer with reaction, kinetic regimes, liquid film enhancement factor, significance of Hatta number, towers for absorption.		

PRACTICAL		
PRACTICAL NO.01	**Isothermal Batch Reactor**	**2 HOURS**
To study the kinetics of a reaction at isothermal conditions using batch reactor.		
PRACTICAL NO.02	**Continuous Stirred Tank Reactor (CSTR)**	**2 HOURS**
To study the kinetics of a reaction at ambient conditions using CSTR.		
PRACTICAL NO.03	**Plug Flow Reactor (PFR)**	**2 HOURS**
To study the kinetics of a reaction at ambient conditions using PFR.		
PRACTICAL NO.04	**Combined Flow Reactor**	**2 HOURS**
To study the kinetics of a reaction using a PFR followed by CSTR.		
PRACTICAL NO.05	**Cascade CSTR**	**2 HOURS**
To study the kinetics of a reaction using three CSTRs in series.		
PRACTICAL NO.06	**RTD Studies in PFR (Pulse input)**	**2 HOURS**
To study the residence time distribution in PFR for pulse input.		
PRACTICAL NO.07	**RTD Studies in CSTR (Step input)**	**2 HOURS**
To study the residence time distribution in CSTR for step input.		
PRACTICAL NO.08	**Packed Bed Reactor**	**2 HOURS**
To study the kinetics of a homogeneous reaction using a packed bed reactor.		
PRACTICAL NO.09	**Catalytic Reactor**	**2 HOURS**
To study the kinetics of a homogeneous/solid catalyzed reaction.		
PRACTICAL NO.10	**Stirred Cell Reactor**	**2 HOURS**
To study the kinetics of a gas-liquid reaction using a stirred cell reactor.		
PRACTICAL NO.11	**Simulation of Reactors - I**	**2 HOURS**
To study the steady state simulation of equilibrium and conversion reactors in Aspen Hysys.		
PRACTICAL NO.12	**Simulation of Reactors - II**	**2 HOURS**
To study the steady state simulation of CSTR and PFR in Aspen Hysys.		

TEXT BOOK

1. O Levenspiel, Chemical Reaction Engineering, 3rd edition, John Willey & sons, 1998, ISBN-13:9788126510009.

REFERENCE BOOKS

1. H Scott Fogler, "Elements of Chemical Reaction Engineering" , Prentice Hall; 4th edition, 2005, ISBN-13: 9780130473943.
2. J M Smith, Chemical Engineering Kinetics, 3rd edition, McGraw-Hill Inc., 1990, ISBN-13:9780070665743.
3. C G Hill, "An Introduction to Chemical Reaction Kinetics and Reactor Design", John Wiley & sons; 1st edition, 1977, ISBN-13: 978-1118368251.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Process Engineering
	COURSE CODE	CH351
	COURSE CREDITS	4
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH223: Momentum Transfer, CH231: Heat Transfer, CH233: Mass Transfer

COURSE OBJECTIVES :

CH351.CEO.1: Learn the fundamentals of process engineering and understand the role of process engineer.
CH351.CEO.2: Know the basis of PFD and P&ID diagrams.
CH351.CEO.3: Learn the process for design of piping, fluid moving devices and flow meters.
CH351.CEO.4: Understand the sizing and designing of equipment.
CH351.CEO.5: Learn the selection of equipment as per requirement.
CH351.CEO.6: Understand the design procedure of process equipment.

COURSE OUTCOMES :

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

CH351.CO.1: Relate the role of process engineer.
CH351.CO.2: Implement the appropriate symbol in process diagram.
CH351.CO.3: Correlate the devices in process designing.
CH351.CO.4: Calculate the process synthesis and equipment data.
CH351.CO.5: Evaluate the data for process development.
CH351.CO.6: Design the process equipment as per given requirement.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Process Engineering & Operation**	**7 HOURS**
Overview of process industry and role & responsibilities of process engineer, alternate routes in process engineering, generalized approach to chemical plant design, preparation of operating instructions manual, conductance of performance test runs, troubleshooting, cost cutting measures, green engineering.		
UNIT 2	**Process Synthesis & Development**	**8 HOURS**
Preliminary database creation- Thermo-physical-chemical property data, Safety data, Prices data, Experiments, Process synthesis, Synthesis steps / tree. Expertise for chemical process synthesis: selection of raw materials & reaction paths, distribution (excess / inert) of constituents, separation processes, reactor heating & cooling systems, heat exchangers & fired heaters.		
UNIT 3	**Process Diagram in Process Engineering**	**8 HOURS**
Relevant codes and standards used in industry, symbols for P&ID, PFD and P&ID for process equipments, need of PFD and P&ID, block diagram, development and utility of PFD , piping and instrumentation diagram. Material selection, MSD (Material selection Diagram), DPDT Diagram (Design Pressure, Design Temperature Diagram)		
UNIT 4	**Process design of Piping and Fluid Moving Devices**	**7 HOURS**
Process design of piping, fluid moving devices, pumps performances with viscous liquids, power required in fan, blower & compressors.		
UNIT 5	**Sizing and Design of Equipments**	**7 HOURS**
Sizing of valve, Safety valve sizing; pump selection and sizing; reactor sizing, pump design, pumps and control valve hydraulic calculations, process designing calculations guidelines for separators, columns, HE, etc, utility packages / utility selection / utility sizing.		
UNIT 6	**Process Design of Equipment**	**8 HOURS**
Design of Liquid-Liquid Extractor: Industrial applications of Liquid-Liquid Extraction, phase equilibrium, desirable solvent properties, design of counter current multistage extractor, industrially importance extractors. Design and Operation of Adsorption Equipment: Selection criteria and design of selection, pressure swing adsorption.		

PRACTICAL		
PRACTICAL NO.01	**Process Flow Diagram**	**2 HOURS**
Development of PFD for a given process.		
PRACTICAL NO.02	**Process & Instrumentation Diagram**	**2 HOURS**
Development of P&ID for a given process		
PRACTICAL NO.03	**Process Data Sheet**	**2 HOURS**
Development of process data sheets		
PRACTICAL NO.04	**Design of Jackets**	**2 HOURS**
Design of various types of jackets		
PRACTICAL NO.05	**Creating a Material Stream**	**2 HOURS**
Defining Simulation Configuration Wizard window & adding a stream to the flow sheet in DWSIM		
PRACTICAL NO.06	**Introduction to Flow sheeting**	**2 HOURS**
Adding mixer to the flow sheet adding streams connecting the material streams defining single phase and two phase streams in DWSIM		
PRACTICAL NO.07	**Simulation of Reactors**	**2 HOURS**
Simulation and defining reaction of Plug Flow Reactor (PFR) /Continuous Stirred Tank Reactor (CSTR) / Equilibrium Reactor with DWSIM		
PRACTICAL NO.08	**Absorption Column**	**2 HOURS**
DWSIM Simulation of Absorption column		
PRACTICAL NO.09	**Unit Operation and Developing Process Simulation**	**2 HOURS**
Adding various unit operation and developing process simulation with PRO II		
PRACTICAL NO.10	**Comprehensive Process Simulation**	**2 HOURS**
PRO II Comprehensive Process Simulation		

TEXT BOOKS

1. Thakore & Bhatt, Introduction to Process Engineering and Design, Tata McGraw-Hill Education, 2007, ISBN: 0070634157, 9780070634152.
2. A. Kayode Coker, Ludwig's Applied Process Design for Chemical and Petrochemical Plants, Gulf Professional Publishing; 4th edition, 2007, ISBN : 075067766X, 9780750677660.
3. Stanley M. Walas, Chemical Process Equipment - Selection and Design, Butterworth-Heinemann, 1988, ISBN: 0750693851, 9780750693851.
4. Robin Smith, Chemical Process: Design and Integration, WileyBlackwell; Subsequent edition , 2005, ISBN : 978-0471486817.

REFERENCE BOOKS

1. Harry Silla, Chemical Process Engineering Design and Economics, CRC Press, 2003,ISBN: 0824756444, 9780824756444.
2. James Douglas, Conceptual Design of Chemical Processes, McGraw-Hill Chemical Engineering Series, 1988, ISBN: 0070177627, 978-0070177628.
3. Dale F. Rudd, Charles Churchill Watson, Strategy of Process Engineering Paperback, John Wiley & Sons Inc, 1971, ISBN: 0471744506, 9780471744504.
4. Daniel R. Lewin, J.D. Seader and Warren D Seider, Product and Process Design Principles: Synthesis, Analysis and Design, 2015, ISBN: 9780470472910.
5. Richard Turton, Joseph A. Shaeiwitz, Debangsu Bhattacharyya, Wallace B. Whiting, Analysis, Synthesis and Design of Chemical Processes, 5th Edition, Prentice Hall, 2018, ISBN: 0134177657, 9780134177656.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Energy Technology
	COURSE CODE	CH352
	COURSE CREDITS	4
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH224: Chemical Engineering Thermodynamics, CH231: Heat Transfer

COURSE OBJECTIVES :

CH352.CEO.1: Know the conventional and renewable energy sources.
CH352.CEO.2: Understand the various ways to harness energy.
CH352.CEO.3: Understand the energy conservation and conversion techniques.
CH352.CEO.4: Develop the insight to use proper energy techniques tools.

COURSE OUTCOMES :

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

CH352.CO.1: Classify the conventional and renewable energy sources.
CH352.CO.2: State the various applications of each form of energy.
CH352.CO.3: Make appropriate use of the energy conversion tools.
CH352.CO.4: Develop a system based on non-conventional energy sources.

THEORY COURSE CONTENT		
UNIT 1	**Conventional Energy Sources**	**7 HOURS**
Energy demand, resources and routes: Indian scenario, projected growth of energy supply in India, fossil fuels, types of coal, classification of Indian coals, coal conversion technologies, coal gasification, coal liquefaction, petroleum and natural gas, energy routes of petroleum, products of petroleum refining, natural gas refinery, liquefaction of natural gas.		
UNIT 2	**Solar Thermal Energy**	**7 HOURS**
Solar insolation, solar radiation data for India, merits and limitations of solar energy utilization, solar energy routes, essential subsystems in a solar energy plant, solar thermal collectors, heat transfer fluid, thermal energy storage, solar pond, combined cycle and co-generation power plants.		
UNIT 3	**Biomass Energy**	**7 HOURS**
Origin of biomass, biomass energy resources, biomass conversion processes, incineration, thermochemical conversion, biochemical conversion, liquid and gaseous fuels from biomass, wood pyrolysis, wood to oil processes, ocean biomass energy conversion.		
UNIT 4	**Waste to Energy**	**7 HOURS**
Urban solid waste, agricultural waste, waste incineration, waste pyrolysis, landfill gas, biogas, types of biogas plants, significance of biogas plants in Indias energy strategy, Uhde-Shwarting process of two stage wet fermentation, dry anaerobic digestion process of municipal solid waste.		
UNIT 5	**Fuel Cells and Hydrogen**	**7 HOURS**
Advantages of fuel cell power sources, classification and types of fuel cells, performance characteristics, commercial fuel cell power plants, future prospects, production of hydrogen, storage and transportation, applications of hydrogen as an energy source.		
UNIT 6	**Energy Storage Systems**	**7 HOURS**
Compressed air energy storage, battery energy storage systems, superconducting magnet energy storage, advanced flywheel energy storage, thermal energy storage, chemical material energy storage.		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Adiabatic Turbine		
PRACTICAL NO.02		**2 HOURS**
Rankine Power Generation Cycle		
PRACTICAL NO.03		**2 HOURS**
Organic Rankine Cycle		
PRACTICAL NO.04		**2 HOURS**
Properties of Coal		
PRACTICAL NO.05		**2 HOURS**
Design of Biogas Plant		
PRACTICAL NO.06		**2 HOURS**
Design of Solar Collector		
PRACTICAL NO.07		**2 HOURS**
Design of Fuel Cell		
PRACTICAL NO.08		**2 HOURS**
Design of Energy Storage System		

TEXT BOOK

1. Rao S., Parulekar B. B., Energy Technology Nonconventional, Renewable and Conventional, Khanna Publishers, 3rded.1999, ISBN: 8174090401.

REFERENCE BOOKS

1. Boyle G., Renewable Energy Power for a sustainable future, Oxford University Press, 2004.
2. Bent Sorensen , Renewable Energy, Elsevier, Academic Press, 2011.

MIT Academy of Engineering (An autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF COMPUTER ENGINEERING AND TECHNOLOGY	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Project Management
	COURSE CODE	HP304
	COURSE CREDITS	2
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY				PRESENTATION/	TOTAL
LECTURE	PRACTICAL	ICE	ECE	IA	PRACTICAL	DEMONSTRATION	
2	NA	NA	50	25	NA	NA	75

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

HP304.CEO.1: Create awareness of organizational strategy for project implementation.
HP304.CEO.2: Understand the rules for creating a Work Breakdown Structure for a Project. .
HP304.CEO.3: Illustrate approaches for risk identification, analysis, and assessment.
HP304.CEO.4: Identify key characteristics of a high-performance project team.
HP304.CEO.5: Understand the critical success factors in project management.

COURSE OUTCOMES :

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

HP304.CO.1: Identify the Project Management Knowledge Areas and Processes.
HP304.CO.2: Classify the responsibilities while designing the Project Master Plan.
HP304.CO.3: Outline the Cost Estimating and Cost Escalation Process.
HP304.CO.4: Demonstrate and highlight The Processes of Project Quality Management.
HP304.CO.5: Analyze Management of a Project and Maturity Models.

THEORY :		
UNIT 1	**Basics of Project Management**	**6 HOURS**
Contents: Introduction, Need for Project Management, SMART Project, Knowledge Areas and Processes, The Project Manager and Project Management Office, Phases of Project Management Life Cycle, Project environments, Impact of Delays in Project Completions **Case Study:**		
UNIT 2	**Systems and Procedures for Planning and Control**	**5 HOURS**
Contents: Type of Projects, The Project Master Plan, The Project Charter, Project Organization and Responsibilities, Work Breakdown Structure (WBS), Networks Diagrams, The Critical Path, Gantt Charts and Calendar Schedules, CPM, PERT (Project Management Tools: GanttProject, OpenProj) **Case Study:**		
UNIT 3	**Cost Estimating, Budgeting and Risk Management**	**5 HOURS**
Contents: Cost Estimating and Cost Escalation, Cost Estimating Process, Elements of Budgets and Estimates, Risk Management process, Project Risk by Phases, Risk Assessment, Risk Response Planning, Risk Tracking and Response **Case Study:**		
UNIT 4	**Project Quality Management and Organization Behavior**	**5 HOURS**
Contents: The Concept of Quality, The Processes of Project Quality Management, Techniques for Quality Assurance during System Development, Stakeholders, Managing Participation, Teamwork and Conflict. **Case Study:**		
UNIT 5	**The Corporate Context**	**5 HOURS**
Contents: Project Management Maturity and Maturity Models, Knowledge and Time Management, International Projects and associated problems, Entrepreneurs and Startup. **Case Study:**		

TEXT BOOK

1. Project Management for Business, Engineering, and Technology, 3rd Edition, John M. Nicholas and Herman Steyn ELSEVIER ISBN: 978-0-7506-8399-9.
2. Project Management Planning and Control, Managing Engineering, Construction and Manufacturing Projects to PMI, APM and BSI Standards, Seventh Edition, Eur Ing Albert Lester, B H Copyright 2017 Elsevier Ltd, ISBN: 978-0-08-102020-3.
3. Project Management in Product Development, George Ellis, Copyright 2016 Elsevier Inc, ISBN: 978-0-12-802322-8.
4. Project Management best Practices, 4th Edition, HAROLD KERZNER, Wiley Copyright 2018, ISBN 978-111-9-46885-1.

REFERENCES

1. Project Management Toolbox, Second Edition, Russ J. Martinelli, Dragan Z. Milosevic, Wiley Copyright 2018, ISBN 978-1-118-97312-7.
2. Project Management Essentials You Always Wanted To Know, Kalpesh Ashar, VIBRANT PUBLISHERS
3. The Practical guide to Project Management, 1st Edition, Christine Petersen, ISBN 978-87-403-0524-1
4. Beginning Project Management (e book), John M. Preston
5. Project Management from Simple to Complex, Russell W. Darnall, John M. Preston, The Open University of Hong Kong

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Skill Development Lab (CFD)
	COURSE CODE	CH344
	COURSE CREDITS	2
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

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

PRE-REQUISITE : CH223: Momentum Transfer; CH231: Heat Transfer

COURSE OBJECTIVES :

CH344.CEO.1: Introduction to Computational Fluid Dynamics (CFD).
CH344.CEO.2: CFD workflow or steps involved in CFD analysis.
CH344.CEO.3: CAD preparation and Mesh generation in CFD.
CH344.CEO.4: Simulation and Post-processing in CFD.
CH344.CEO.5: Turbulence modeling basics.
CH344.CEO.6: Heat transfer modeling.

COURSE OUTCOMES :

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

CH344.CO.1: Use a CAD tool for preparing CFD specific CAD models.
CH344.CO.2: Create high quality CFD simulation meshes from imported CAD geometry.
CH344.CO.3: Complete a basic CFD simulation including defining the problem, calculating the solution and post-processing the results.
CH344.CO.4: Learn to interpret the results by qualitative and quantitative post-processing.
CH344.CO.5: Perform all steps of a CFD simulation from CAD import to meshing to solution to results.
CH344.CO.6: Perform a flow and heat transfer simulation.

PRACTICAL		
PRACTICAL NO.01	**Creating a T-Junction CAD Model**	**4 HOURS**
Understanding the GUI layout and basics of sketching for creating a simple T-Junction CAD model		
PRACTICAL NO.02	**Repairing Imported CAD and Fluid Volume Extraction**	**4 HOURS**
Importing a CAD file, repairing the model and extracting the fluid volume for internal flow		
PRACTICAL NO.03	**Mesh generation: T-Junction model**	**4 HOURS**
Understand the mesh generation workflow for a simple T-Junction model. Mesh sizes to be given and different mesh types that could be used.		
PRACTICAL NO.04	**Mesh generation: Imported CAD model**	**4 HOURS**
Generate mesh for the previously imported CAD model wherein fluid volume is already extracted. Apply inflation layers on the boundaries and region-specific surface and volume refinement.		
PRACTICAL NO.05	**Solution workflow: T-Junction model**	**4 HOURS**
Solution workflow with regards to problem definition, specifying boundary conditions, material specification, specifying type of flow and performing simulation with the default solver settings.		
PRACTICAL NO.06	**Solution: Imported CAD model**	**4 HOURS**
Simulating the imported CAD model and understanding the effect of different solver parameters on the results.		
PRACTICAL NO.07	**Post-processing: T-Junction model**	**4 HOURS**
Understanding different qualitative and quantitative post-processing that could be done on a CFD simulation.		
PRACTICAL NO.08	**Turbulence modeling: T-Junction model**	**4 HOURS**
Understanding turbulence modeling and simulating the effect of different turbulence models on the results.		
PRACTICAL NO.09	**Heat transfer simulation: T-Junction model**	**4 HOURS**
Understanding heat transfer modeling and simulating a simple heat transfer problem for the T-Junction model.		
PRACTICAL NO.10	**Project Work**	**4 HOURS**
Students will be given the Project Topics / Case Studies related to preferably Fluid Flow and Heat Transfer applications in Chemical Engineering. The results from the simulation would be compared with literature or hand calculation values. Examples: Flow in different types of Static Mixers, CSTR, Flow and Heat transfer in double pipe heat exchangers.		

TEXT BOOKS

1. H K Versteeg and W Malalasekera. (2008), An Introduction to Computational Fluid Dynamics, 2nd Ed., Pearson Education, ISBN-13: 978-8131720486.
2. Joel H. Ferziger, Milovan Peri, Robert L. Street, Computational Methods for Fluid Dynamics, Springer Publication, ISBN-13: 978-3319996912.

REFERENCE BOOKS

1. Elizabeth Marden Marshall and Andr Bakker (2002), Computation Fluid Mixing, 1st Ed., Fluent, Incorporated, ISBN 0971953201, 9780971953208.
2. John Matsson (2019), An Introduction to ANSYS Fluent 2019, SDC Publications, ISBN-13: 978-1630573300.

MIT | Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY IN CHEMICAL ENGINEERING	COURSE NAME	Project Design
	COURSE CODE	CH345
	COURSE CREDITS	2
RELEASE DATE : 01/07/2021	REVISION NO	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	ICE	ECE	IA			
NIL	4	NIL	NIL	25	NIL	50	75

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH345.CEO.1: To embrace innovation and creativity in project design while empathizing real world needs.
CH345.CEO.2: To acquaint with requirement analysis process and techniques.
CH345.CEO.3: To inculcate the agile project management tools for project design and planning.
CH345.CEO.4: To upskill in quality technical writing and related tools for project documentation.

COURSE OUTCOMES :

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

CH345.CO.1: Delineate the problem to be solved.
CH345.CO.2: Inculcate problem solving skills by critically analyzing real world needs, possible solutions and challenges.
CH345.CO.3: Carry out systematic literature review, planning and project design.
CH345.CO.4: Cognize the importance of documentation and report writing.

COURSE ABSTRACT

The project is most important part of undergraduate curriculum and enables students to develop analytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation. To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Project Design, Project Implementation and Project Evaluation. The first phase of Project Design mainly focuses on formulating systems requirement, background/literature review, and defining scope, objective and apply project management/modeling tools to design proposed solution. This enables students to apply their technical acumen and innovativeness in proposing methodology, milestones, and expected outcome.

GUIDELINES

1. Every project group should consist of minimum 03 and maximum of 04 students.
2. The group members may be from different programs to support the interdisciplinary functioning.
3. Project group members and title of the project need to be approved by Project Guide and School.
4. Projects should preferably have a national/international industry/academic/research collaboration.
5. User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
6. The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.
7. Define proposed solution and apply project management/modeling tools for project planning and design.
8. Critically analyze various solutions/techniques to solve real world problems and perform feasibility study to select and justify proposed solution.
9. Define outcome, milestones, definite roadmap for project design, implementation, evaluation and documentation.

Collaborative/Sponsored Project

1. Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for final project work.
2. Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization, anytime before the commencement of the sixth semester.
3. Proposed Collaborative Project work need to reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of minimum 12 months to 18 months.
4. Final assessment will be carried out in presence of faculty mentor, external mentor and examiner.

TIMELINE

1. Exploration of fore front research/specialization areas and opportunities in the various fields.
2. Formation of Project Group. Finalization of area of work/title as per forefront areas.
3. Exploration of abridged courses, valid resources, challenges, relevance with current opportunities.
4. Project Review I Presentation.
5. Background study Systematic literature review.
6. Literature review documentation for Project Report and Research Article.
7. Define problem statement and objectives.
8. Define scope of the work and Outline of the work.
9. Project Review II Presentation.
10. Project Design, Modelling, Simulation etc.
11. Proposed Methodology of the solution and its documentation.
12. Project Documentation: Project Report Writing, Final Synopsis
13. Project Documentation: Ethics in Writing
14. Project Review III Presentation

ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Internal Assessment (25 Marks)
   (a) Project Review I: Problem Identification, Motivation and Relevance
   (b) Synopsis
   (c) Project Review II: Background Study, Literature Review and Problem Definition
   (d) Background Study and Literature Review
   (e) Project Review III: Project Planning, Analysis and Design
2. Project Demonstration (50 Marks)
   (a) Project Report
   (b) Final Presentation and Demonstration

REFERENCE BOOKS

1. Nicholas John M.,"Project Management for Engineering, Business and Technology", Butterworth Heinemann, ISBN: 9780080967042
2. Michelle Reid, "Report Writing (Pocket Study Skills)"', Second Edition, Macmillan Eduation.
3. Sara Efrat Efron, Ruth David, "Writing the Literature Review : A Practical Guide", Guilford Press, ISBN-13: 978-1462536894.
4. Leslie Lamport,"LaTeX: A document preparation system, Users guide and reference manual", Second Edition 1994, Addison Wesley, ISBN: 978-0201529838.
5. Michel Goossens, Frank Mittelbach, Sebastian Rahtz, Denis Roegel and Herbert Voss,"The LaTeX Graphics Companion", Second Edition 2007, Addison-Wesley Professional, ISBN: 078-5342508925.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2020 - 2021 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Student Internship Program (Soft Skill/Technical Skills)
	COURSE CODE	CH300
	COURSE CREDITS	Audit
RELEASE DATE : 01/07/2020	**REVISION NO**	0.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH300.CEO.1: To develop good bahavioural practices
CH300.CEO.2: To gain learning and living experience
CH300.CEO.3: To get acquainted with online learning platforms
CH300.CEO.4: To recognize the latest trend and understand the requirements for professional life
CH300.CEO.5: To formulate the problem statement

COURSE OUTCOMES :

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

CH300.CO.1: Manage emotions, health, finances, relationships, performance extracurricular activities
CH300.CO.2: Increase knowledge of emotional competency and emotional intelligence
CH300.CO.3: Develop interpersonal skills and adopt good leadership behavior
CH300.CO.4: Reduce negative stress while promoting eustress, or positive stress
CH300.CO.5: Inculcate a sense of sportsmanship, better physical health and competitive spirit

INTRODUCTION:

The main aim of this internship is to assist all Third Year B.Tech. students to acquire the skills required for personal stability and professional growth. The ultimate goal is to imbue students with professionalism and technical skills. Using this internship, MITAoE students will enhance their professional skills, making themselves more marketable in todays competitive world. The students can develop various extracuurricular skills for working on emotional intelligence and sportsman spirit.

SCOPE AND STRUCTURE OF SIP:

This internship is offered to entrants of Third Year B.Tech. (after semester IV) that meet the eligibility criteria stated below:
Third Year B.Tech. entrants should apply for 3 to 4 weeks duration training or certification courses during June-July of every academic year. This is an audit course.

The scope of this internship is limited to identifying soft skill/ technical skill development opportunities and assisting MITAoE students to apply for such courses.

STUDENT ELIGIBILITY CRITERIA:

Students applying for internship must meet the following criteria:
After completion of fourth academic semester, Second Year B.Tech. students (Third Year B.Tech. entrants) of all schools are eligible to apply for 3 to 4 weeks duration internships under student internship program.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Process Dynamics and Control
	COURSE CODE	CH361
	COURSE CREDITS	4
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH342: Separation Process

COURSE OBJECTIVES :

CH361.CEO.1: Make aware of dynamics of different systems.
CH361.CEO.2: Learn about the use of computer application in control system design.
CH361.CEO.3: Application of the system stability criterion.
CH361.CEO.4: Develop the plant wide control system.

COURSE OUTCOMES :

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

CH361.CO.1: Experiment transfer functions of different systems and their response required for stability analysis.
CH361.CO.2: Categorize controller tuning for stable systems in chemical process plants.
CH361.CO.3: Apply various softwares used for control systems.
CH361.CO.4: Identify multiple loops and use the computers in process control in chemical process industries.
CH361.CO.5: Compare stable & unstable systems by Bode Stability criterion.
CH361.CO.6: Evaluate control system for various process operations.

THEORY COURSE CONTENT		
UNIT 1	**Dynamic Behaviour of Simple Processes**	**7 HOURS**
Instrumentation Basics: List of Temperature, Pressure, Level and flow measuring devices. Introduction to Characteristics of Chemical Process Control, Mathematical modeling of a chemical process, State variables and state equation, Input-Output model, Types of Forcing functions, dead-time systems, First order systems Thermometer, Liquid level tank, Liquid level tank with constant outlet (pure capacitive), CSTR, Dynamic response of first order system to step input.		
UNIT 2	**Single Loop Feedback Control Systems**	**7 HOURS**
Second order system U-tube manometer, Interacting and Non-interacting systems, Step response of second order system, Characteristics of underdamped system. Classical controllers P, PI, PD, PID and ON-OFF controllers. Concept of feed-back control system, Servo & Regulatory problem, Block diagram reduction of complicated control systems, and Dynamic behavior of feed-back control processes..		
UNIT 3	**Stability Analysis of Feedback Systems**	**7 HOURS**
Notion of stability, Characteristic equation, stability analysis of feedback control system using Routh-Hurwitz criteria, Root locus. Simple performance criteria controller tuning with one-quarter decay ratio criteria, Time Integral performance criteria by ISE, IAE, ITAE, etc., selection of feed-back controller, Controller tuning using process reaction curve by Cohen-coon technique.		
UNIT 4	**Frequency Response Analysis of Linear Processes**	**7 HOURS**
Response of first order system to sinusoidal input, Frequency response characteristics of general linear system, Bode diagrams - First order system, Second order system, Pure capacitive process, dead time system, P, PI, PD & PID, Bode stability criteria, Gain margin, Phase Margin, Nyquist Stability criteria, Ziegler Nicholes Tuning technique.		
UNIT 5	**Digital and Computer Based Control Systems**	**7 HOURS**
Analysis and design of control systems with multiple loops (cascade, selective, split range control systems) Analysis and design of advanced control systems (feed forward, ratio, adaptive and inferential control systems. Role of digital computer in process control as process interface for data acquisition and control, Centralized control systems.		
UNIT 6	**PLC and SCADA Control Systems**	**7 HOURS**
Supervisory control systems (SCADA), microcomputer- based control systems (PLC, DCS), Plant wide control for plants involving Distillation column, Heat Exchanger, CSTR, Controller Selection.		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Dynamic Response of Thermometer (First Order)		
PRACTICAL NO.02		**2 HOURS**
Dynamic Response of Thermocouple (First Order)		
PRACTICAL NO.03		**2 HOURS**
Time Constant of Thermometer - Second Order System		
PRACTICAL NO.04		**2 HOURS**
Temperature Control Study		
PRACTICAL NO.05		**2 HOURS**
Time Constant of Manometer		
PRACTICAL NO.06		**2 HOURS**
Two Tank Interacting System		
PRACTICAL NO.07		**2 HOURS**
Two Tank Non-Interacting System		
PRACTICAL NO.08		**2 HOURS**
Feedback Flow Experiment on SCADA		
PRACTICAL NO.09		**2 HOURS**
Feedback Level Experiment on SCADA		
PRACTICAL NO.10		**2 HOURS**
Feedback Pressure Experiment on SCADA		
PRACTICAL NO.11		**2 HOURS**
Level Control Systems by Python Coding/Aspen/PLC SCADA Software		
PRACTICAL NO.12		**2 HOURS**
Temperature Control Systems by Python coding/Aspen/PLC SCADA Software		
PRACTICAL NO.13		**2 HOURS**
Cascade Control System		
PRACTICAL NO.14		**2 HOURS**
Various Chemical Engineering Control System Case studies by PROSIM Software		

TEXT BOOKS

1. Stephanopoulos George Chemical Process Control, PHI publication, (ISBN 8120306651).
2. Coughanour Donald R. Process System Analysis & Control, Mc Graw Hill.

REFERENCE BOOKS

1. Bequette B. Wayne Process Control Modeling, Design & Control , PHI Publication, Hardcover, (ISBN 0133536408).
2. MellichampDancan A., Edgar Thomal F., Seborg Dale E Process Dynamics & Control.
3. Ray W. Harmon, Ogunnaike Babatunde A., Process Dynamics, Modeling & Control, Oxford University Press Inc.
4. Chindambaram M. Computer Control of Processes, Alpha Science International Ltd.
5. Liptak Bella G. Instrument Engineers Handbook (Process Control), Elsevier, (ISBN 0849310822).

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Chemical Equipment Design I
	COURSE CODE	CH362
	COURSE CREDITS	4
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH231: Heat Transfer, CH341: Chemical Engineering Operations

COURSE OBJECTIVES :

CH362.CEO.1: Give comprehensive knowledge of various process equipment used in the chemical industries.
CH362.CEO.2: Provide knowledge about design principles of pressure vessels used in chemical plants.
CH362.CEO.3: Impart knowledge about mechanical design of equipment.
CH362.CEO.4: Impart the knowledge of various design aspects and specifications used for process equipment.
CH362.CEO.5: Explain and calculate various design parameters for process equipment.
CH362.CEO.6: Implement the knowledge of mechanical design of various process equipment.

COURSE OUTCOMES :

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

CH362.CO.1: Describe the basics of process equipment design and important parameters of equipment design.
CH362.CO.2: Design different types of pressure vessels.
CH362.CO.3: Apply the complete knowledge of equipment fabrication and testing methods.
CH362.CO.4: Implement the various codes and standards used for equipment design.
CH362.CO.5: Find out the suitable material of construction, fabrication methods for various process equipment.
CH362.CO.6: Apply their knowledge for designing of process equipment.

THEORY COURSE CONTENT		
UNIT 1	**General Concepts and Methods of Mechanical Design of Pressure Equipments**	**8 HOURS**
Introduction about Process Industry and EPC(Engineering procurement and construction),List of Equipments used in Industries, their Introduction & Applications, Relevant Codes and Standards used in Industry. Stress Strain Diagram, Material Selection for Different Temperature & Services, Loads and Stresses: Elements of Stress Analysis, Stress Categorization, Load Conditions & Failure Modes, theories of failure. Design Methods: DBF(Design by formula), DBA(Design by analysis) and Design by Experiment.		
UNIT 2	**Fabrication and Codes for Pressure Vessel**	**8 HOURS**
Plate rolling, Plate Bending, Welding Methodologies (STAW, GTAW, GMAW, SMAW), Welded Joints: Butt Welded Joints of unequal Thicknesses & Welding Symbols, Fabrication Sequences , Fabrication Schedules, Plate Forming, Cutting etc. Testing of Pressure Vessel, Painting and Coating for Corrosion Protection, Impact Testing, PWHT along with Heating Rates and Cooling Rates, Hydro Test Pressure & Stamping of Vessels. Introduction to Engineering Standards used in Design of Process Equipment's, ASME, TEMA, and API etc. Conditions/Clauses Governing Pressure Vessel Design under ASME		
UNIT 3	**Mechanical Design of Pressure Vessels**	**8 HOURS**
Design of Pressure Vessel for Internal & External Pressure, Design of Cylindrical and spherical Vessels & Dished. Role of MAP, MAWP, Design Pressure & Design Temperatures, Allowable Stresses, Corrosion Allowance and Loadings as per ASME in PV Design, Joint Efficiency. Flange joints, Nozzle Openings and Reinforcements. Various Types of Supports: Leg, Bracket, saddle and skirt Supports.		
UNIT 4	**Tall Columns and Thick Wall Pressure Vessels**	**8 HOURS**
Design of tall vessels: Introduction, axial stress due to dead loads, axial stresses due to pressures, longitudinal bending stresses due to dynamic loads, design considerations of distillation/Absorption column (tall tower), Design of high pressure monoblock and multilayer vessels.		
UNIT 5	**Heat Exchangers**	**8 HOURS**
Review of process design of shell and tube heat exchanger: Types of heat exchanger, limitations in the use of heat exchangers, Components of Heat Exchangers, general design considerations - LMTD correction factor, fluid allocation, fluid velocities, stream temperatures. Mechanical design of shell and tube heat exchanger: Thickness of shell and shell cover, channel cover, tube sheet, size and number of tie rods and spacers etc. Design of double pipe heat exchanger, Plate heat exchanger: advantages, disadvantages, design procedure, temperature correction factor, heat transfer coefficients, pressure drop.		
UNIT 6	**Auxiliary Process Vessels**	**8 HOURS**
Study of auxiliary equipments for separation of liquid-solid, gas-solid and gas-liquid separators Cyclone, Decanters , Electrostatic Precipitator (ESP), etc.		

PRACTICAL		
PRACTICAL NO.01	**Design & Drawing of Flanges**	**2 HOURS**
Flanges drawings, final drawings can be created using CAD/CATIA softwares		
PRACTICAL NO.02	**Heads**	**2 HOURS**
Pressure vessel heads (CAD/CATIA drawings)		
PRACTICAL NO.03	**Pressure Vessels**	**2 HOURS**
Pressure vessel design (CAD/CATIA drawings)		
PRACTICAL NO.04	**Supports**	**2 HOURS**
Design of supports & drawing with CAD/CATIA		
PRACTICAL NO.05	**Tall Vessels**	**2 HOURS**
Tall vessels (CAD/CATIA drawings)		
PRACTICAL NO.06	**Heat Exchanger**	**2 HOURS**
Double Pipe Heat Exchanger (CAD/CATIA drawings)		
PRACTICAL NO.07	**Heat Exchanger**	**2 HOURS**
Shell and Tube Heat Exchanger (CAD/CATIA drawings)		
PRACTICAL NO.08	**Cyclone Separator**	**2 HOURS**
Cyclone Separator (CAD/CATIA drawings)		
PRACTICAL NO.09	**Industrial Drawing of Equipments**	**2 HOURS**
Hand Drawing of industrial equipments with standard P&ID symbols		

TEXT BOOKS

1. Brownell L.E. and Young H.E, rocess Equipment Design, John Wiley, 2004. (ISBN :9780471113195).
2. Joshi M.V, Mahajani V.V, Process Equipment Design, 5th Edition, MacMillan Publishers India limited (ISBN : 9780333924181).
3. Dawande S.D, Process Design of Equipment, Central Techno Publications, Nagpur, 2000 (ISBN :8190322885)

REFERENCE BOOKS

1. Sinnott R.K, Chemical Engineering Series, Vol. 6, 4th Edition, Butterworth Heinemann (ISBN :9780080418667).
2. Richardson J.F, Harker J.H. and Backhurst J.R, Chemical Engineering, Vol. 2, 5th Edition, Butterworth- Heinemann. (ISBN : 9780750644457).
3. Kern D.Q, Process Heat Transfer, McGraw-Hill, Revised edition, 1999 (ISBN : 9780070341906).
4. James R Couper, Walas S.M, Chemical Process Equipment: Selection and Design, Gulf Professional Publishing, 1988 (ISBN : 9780409901313).

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Chemical Process Technology
	COURSE CODE	CH363
	COURSE CREDITS	3
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	35	35	30	NIL	NIL	100

PRE-REQUISITE : CH341: Chemical Engineering Operaations, CH342: Separation Process

COURSE OBJECTIVES :

CH363.CEO.1: Understand standard equipment symbols, process control and instrumentation symbols used for flow sheeting.
CH363.CEO.2: Recognize different industry, their products and role of chemical engineer in industry.
CH363.CEO.3: Know manufacturing of various chemicals and sequence of operations and their importance.
CH363.CEO.4: Analyze importance of raw material quality and specification.
CH363.CEO.5: Understand selection of process and effect of operating parameters.
CH363.CEO.6: Know major engineering problems.

COURSE OUTCOMES :

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

CH363.CO.1: Classify chemical industries.
CH363.CO.2: Interpret manufacturing Flowsheet.
CH363.CO.3: Recognize specification of different raw material and its importance.
CH363.CO.4: Evaluate effect of operating parameter on quality.
CH363.CO.5: Apply appropriate parameters for process selection.
CH363.CO.6: Interpret major engineering problems associated with process.

THEORY COURSE CONTENT		
UNIT 1	**Basic Concepts of Process Industries**	**7 HOURS**
A. Theory of Unit operations and industrial equipment and systems used in large scale plants; Unit processes, Development of ow diagram, schematic representation and application for unit operations and unit processes. B. Study the selection and process specific applications knowing available industrial equipment and plant accessories..		
UNIT 2	**Sulfur and Sugar Industry**	**7 HOURS**
A. Importance, manufacturing of sulfur by Frasch process, technology for the manufacturing of sulfuric acid. Detailed study and comparison between chamber and DCDA processes; process economics. B. Sugar Industry: Manufacture of sugar and engineering problems associated Dextrin and starch derivatives..		
UNIT 3	**Nitrogen and Cement Industry**	**7 HOURS**
A. Role of nitrogen in fertilizers, manufacturing of ammonia, nitric acid, urea, the above study must involves different routes adopted, limitations, advantages and disadvantages of the process; steamreforming process technology. B. Importance of Cement and Lime and Production of Cement by rock beneficiation process and Portland cement. Importance of Lime and Manufacturing of lime.		
UNIT 4	**Phosphorus and Paper Pulp Industry**	**7 HOURS**
A. Importance, manufacturing of super phosphate, triple super phosphate, phosphoric acid, Electro thermal processes and NPK fertilizers, Flow sheet and process for manufacture of Phosphoric acid from phosphate rock. B. Production of pulp, engineering problems involved, paper manufacturing from pulp comparison of methods of manufacturing.		
UNIT 5	**Chlor-Alkali and Steel Industry**	**7 HOURS**
A. Chlor-alkali chart and importance of chlor-alkali industry, manufacturing processes process economics, and plants in India and a few examples of latest technology used in other nations;Manufacturing of soda ash, caustic soda, chlorine and engineering problems. B. Blast Furnace construction details and Uses. Manufacturing of Iron and steel.		
UNIT 6	**Organic Industry**	**7 HOURS**
A: Petroleum Refinery: Cracking: Thermal and catalytic cracking, FCC, Reforming B: Petrochemical: Methanol production, ethylene production, Polythene production.		

TEXT BOOKS

1. 1. Dryden C.E. and Rao M.G, Outlines of Chemical Technology, Affiliated East West Press, 2010, (ISBN: 9788185938790).
2. Austin G.T, Sherves Chemical Process Industries, 5th Edition, McGraw Hill, (ISBN: 9780070661677).
3. Groggins P.H, Unit process in organic synthesis, 5th Edition, McGraw Hill, 2004, (ISBN: 9780074621431).

REFERENCE BOOKS

1. Kirk & Othmer, Concise Encyclopedia of Chemical Technology, 5th Edition, Wiley Publishers, 2007, (ISBN: 9780470047484).
2. Faith W.L, Lowenheim F.A, Moran M.K, Industrial Chemicals, 4th Edition, Wiley Publishers, (ISBN:9780471549642).
3. Smith, R, Chemical Process Design and Integration, 3rd Edition, Wiley, 2005.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	COURSE NAME	Process Modeling and Simulation
	COURSE CODE	CH371
	COURSE CREDITS	4
RELEASE DATE : 01/07/2021	REVISION NO	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : AS203: Applied Mathematics, CH351: Process Engineering

COURSE OBJECTIVES :

CH371.CEO.1: Know the types of models and its applications.
CH371.CEO.2: Understand the steps involved in building mathematical model.
CH371.CEO.3: Understand the selection of models for various chemical process.
CH371.CEO.4: Learn the development of mathematical model for various operations.
CH371.CEO.5: Execute model using numerical techniques and software.
CH371.CEO.6: Optimize the process parameters using optimization techniques.

COURSE OUTCOMES :

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

CH371.CO.1: Construct mathematical model and exercise model building procedure for steady and unsteady processes.
CH371.CO.2: Formulate material, energy and momentum balance equations for chemical processes.
CH371.CO.3: Develop mathematical model for heat and mass transfer operations.
CH371.CO.4: Formulate model for chemical reactor systems.
CH371.CO.5: Simulate the model using numerical techniques and software.
CH371.CO.6: Optimize the various parameters to enhance the efficiency of the process.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Process Modeling**	**5 HOURS**
Definition of process model, use and scope of mathematical modeling, principles of model formulation, classification of models, development of mathematical model, degrees of freedom analysis, parameter estimation, selection of design variables, review of numerical techniques, introduction to simulation, role and importance of steady-state and dynamic simulations.		
UNIT 2	**Fundamental Laws**	**7 HOURS**
Continuity equation, energy equation, equation of motion, transport equation, equations of state, phase and chemical equilibrium, chemical kinetics, review of thermodynamic correlations, selection of thermodynamic property methods.		
UNIT 3	**Modeling of Chemical Processes**	**10 HOURS**
Agitated vessel, pressure change equipment, mixing process, two heated tanks, heat exchanger, single and multiple effect evaporators, batch distillation, continuous distillation for binary and multicomponent systems, single stage and multi-stage extraction, absorber and stripper, batch reactor, constant/variable volume CSTR, gas-phase pressurized CSTR, non-isothermal CSTR, reactor combinations.		
UNIT 4	**Process Simulation**	**6 HOURS**
Simulation of process models, sequential modular approach, equation oriented approach, partitioning and tearing: steady-state lumped system-partitioning equation, tearing equation, simultaneous equations, decomposition of networks, introduction to various professional process simulation software.		
UNIT 5	**Applications of Modeling and Simulation**	**7 HOURS**
Examples of mathematical models of chemical engineering systems, wastewater treatment plant, use of numerical methods to solve different process models.		
UNIT 6	**Basics of Process Optimization**	**7 HOURS**
Features of optimization problems, general procedure for solving optimization problems, obstacles to optimization, fitting functions to empirical data, formulation of various process optimization problems.		

PRACTICAL		
PRACTICAL NO.01	**Material Balance**	**2 HOURS**
Development of a mathematical model for mass balance		
PRACTICAL NO.02	**Component Balance**	**2 HOURS**
Development of a mathematical model for component balance		
PRACTICAL NO.03	**Energy Balance**	**2 HOURS**
Development of a mathematical model for energy balance		
PRACTICAL NO.04	**Heat Transfer Equipment**	**2 HOURS**
Development of a mathematical model for heat transfer equipment		
PRACTICAL NO.05	**Mass Transfer Equipment**	**2 HOURS**
Development of a mathematical model for mass transfer equipment		
PRACTICAL NO.06	**Reaction Equipment and Systems**	**2 HOURS**
Development of a mathematical model for reactors and reaction systems		
PRACTICAL NO.07	**Chemical Process Plant**	**2 HOURS**
Development of a mathematical model for a chemical process plant		
PRACTICAL NO.08	**Parameter Optimization**	**2 HOURS**
Optimization of process parameters using optimization techniques		
PRACTICAL NO.09	**Optimization of Unit Operations**	**2 HOURS**
Optimization of various unit operations		
PRACTICAL NO.10	**Optimization of Reactors**	**2 HOURS**
Optimization of ideal batch and flow reactors		

TEXT BOOKS

1. Luyben W. L., Process Modelling, Simulation and Control for Chemical Engineers, McGraw-Hill Education, 2nd ed., 1989 (ISBN-13: 978-0070391604).
2. Chidambaram M., Mathematical Modelling and Simulation in Chemical Engineering, Cambridge University Press, 2018, (ISBN-13: 978-1108470407).

REFERENCE BOOKS

1. Westerberg A.W., Hutchison H.P., Motard R.L., Winter P., Process Flowsheeting, Cambridge University Press, 1st ed., 2011 (ISBN-13: 978-0521279154).
2. Chapra S.C., Canale R. P., Numerical Methods for Engineers, McGraw-Hill Education, 7th ed., 2016 (ISBN-13: 978-9352602131).
3. Dorfman K. D., Daoutidis P., Numerical Methods with Chemical Engineering Applications, Cambridge University Press, 1st ed., 2017 (ISBN-13: 978-1107135116).
4. Edgar T. F., Himmelblau D. M., Optimization of Chemical Processes, McGraw Hill Education, 2nd ed., 2001 (ISBN-13: 978-0070393592).

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Energy Modeling and Simulation
	COURSE CODE	CH372
	COURSE CREDITS	4
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH231: Heat Transfer, CH352: Energy Technology

COURSE OBJECTIVES :

CH372.CEO.1: Know energy analysis.
CH372.CEO.2: Recognize component of wind energy systems.
CH372.CEO.3: Understand concept of nuclear energy.
CH372.CEO.4: Know various modeling techniques.
CH372.CEO.5: Apply various simulation software for energy system.
CH372.CEO.6: Know optimization importance for energy systems.

COURSE OUTCOMES :

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

CH372.CO.1: Understand energy analysis.
CH372.CO.2: Design wind energy systems.
CH372.CO.3: Understand concept of nuclear energy.
CH372.CO.4: Apply various modeling techniques for energy systems.
CH372.CO.5: Apply various simulation tools for energy systems.
CH372.CO.6: Understand optimization tools for energy applications.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Energy Modeling Tools**	**8 HOURS**
Why do we need energy modeling software, modeling inputs in general, Residential building energy modeling tools, commercial building energy modeling tools, common energy models and renewable measures, introduction to residential stock modeling tools, Introduction to renewable energy modeling tools, system advisor model for modeling renewable energy.		
UNIT 2	**Wind Energy**	**8 HOURS**
Wind resource assessment, Power Conversion Technologies and applications, Wind Power estimation techniques, Principles of Aerodynamics of wind turbine blade, Various aspects of wind turbine design, Wind Turbine Generators: Induction, Synchronous machine, constant V & F and variable V & F generations, Reactive power compensation. Site Selection, Concept of wind form & project cycle, Cost economics & viability of wind farm.		
UNIT 3	**Nuclear Energy**	**8 HOURS**
Potential of Nuclear Energy, International Nuclear Energy Policies and Regulations. Nuclear Energy Technologies Fuel enrichment, Different Types of Nuclear Reactors, Nuclear Waste Disposal, and Nuclear Fusion.		
UNIT 4	**Mathematical Modeling and Analysis in Renewable Energy**	**8 HOURS**
Covers effective storage and generation of power through renewable energy generation sources., Provides real life applications and problems based on renewable energy, Covers new ways of applying mathematical techniques for applications in diverse areas of science and engineering, Case study: analysis of RSM method in optimization of ultrasound assisted KOH catalyzed biodiesel production from waste cotton seed cooking oil.		
UNIT 5	**Economic Environmental Energy Interactions**	**8 HOURS**
The Evolution of Economic-Energy-Environmental Modelling, Composite Scenarios for Long-term Environmental and Energy Policies, Economics of Alternative Energy Sources, The environmental impact issues in energy development, Feasibility of Application, Economics of Energy Sources, Composite Scenarios for Long-term Environmental and Energy Policies.		
UNIT 6	**Applied Data Analysis and Modeling for Energy Engineers**	**8 HOURS**
Risk analysis, types of decision making problems and applications, engineering decisions involving discrete alternatives, modeling risk attitudes, modeling problem structure using influence diagram and decision trees, formal treatment of risk analysis, decision making while operating an engineering system.		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Determining efficiency of lighting system/loads		
PRACTICAL NO.02		**2 HOURS**
Determining efficiency of lighting system/loads		
PRACTICAL NO.03		**2 HOURS**
Determining efficiency of lighting system/loads		
PRACTICAL NO.04		**2 HOURS**
Wind power and annual energy estimation from wind data		
PRACTICAL NO.05		**2 HOURS**
Fuel: Density, Viscosity, Flash-point, Fire-point Pour-point		
PRACTICAL NO.06		**2 HOURS**
Fuel: ASTM distillation of liquid fuels; Proximate and Ultimate analysis, calorific value of solid fuels		
PRACTICAL NO.07		**2 HOURS**
Pinch analysis		
PRACTICAL NO.08		**2 HOURS**
Heat Exchanger Network (HEN)		
PRACTICAL NO.09		**2 HOURS**
Modelling of energy system (HVAC)		
PRACTICAL NO.10		**2 HOURS**
Simulation of heat exchanger		

TEXT BOOKS

1. Energy for a sustainable world: Jose Goldenberg, Thomas Johansson, A.K.N.Reddy, Robert Williams (Wiley Eastern).
2. Rao S. S. (2004); Engineering Optimization: Theory and Practice, Third Edition, New Age International.
3. Sundaram R. K. (1996); A First Course in Optimization Theory, Cambridge University Press.

REFERENCE BOOKS

1. Wind Turbine Technology: Fundamental concepts of wind turbine technology Spera D.A. (ASME Press, NY, 1994).
2. Meier P. (1984); Energy Systems Analysis for Developing Countries, Springer Verlag.
3. Ravindran A. Ragsdell K. M. and Reklaitis G. V. (2006); Engineering Optimization:methods and applications, Second Edition, Wiley.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Employability and Career Development
	COURSE CODE	HP305
	COURSE CREDITS	2
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
NIL	4	NIL	NIL	25	NIL	50	75

PRE-REQUISITE : HP101: Language and Communication 1, HP102: Language Communication 2

COURSE OBJECTIVES :

HP305.CEO.1: Define the importance of professional skills in students life.
HP305.CEO.2: Explain them necessary, specific professional skills.
HP305.CEO.3: Appraise students for placements through acquisition of professional skills.
HP305.CEO.4: 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,

HP305.CO.1: Relate the importance of professional skills.
HP305.CO.2: Build necessary, specific professional skills.
HP305.CO.3: Analyze the environment of employ-ability.
HP305.CO.4: Develop various techniques of effective team building in their professional life.

PRACTICALS: (SECTION A)		
PRACTICAL NO.01	**Self Awareness**	**2 HOURS**
Concept of JohariWindow, 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.		
PRACTICAL NO.02	**Personal Interviews**	**6 HOURS**
Preparing for Interviews, Typical expected questions & suggested responses, Posture, Body language, Greetings and pleasantries, , Handling unforeseen questions.		
PRACTICAL NO.03	**Group Discussion**	**4 HOURS**
Parameters of assessment, Initiating the discussion, Effective listening, Own contribution, Paraphrasing, Arguing and counter-arguing, Giving direction to the discussion.		
PRACTICAL NO.04	**Team Building and Motivation**	**2 HOURS**
Hallmark of effective teams, Barriers to team work, Subjugation of Individual interests for achievement of teams goal, Leading & motivating team members.		
PRACTICAL NO.05	**Innovative Thinking**	**2 HOURS**
Relevance and importance of innovative thinking, Introduction to Brain Storming technique, Collective and individual Brain Storming.		
PRACTICAL NO.06	**Decision Making**	**2 HOURS**
Levels of decisions, Process of decision-making, Types of criteria, Individual and collective decision-making, Barriers in decision making, Keys to sound decision-making.		

SECTION B	**Aptitude Training**

REFERENCE BOOKS

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).

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Skill Development Lab (Aspen ONE)
	COURSE CODE	CH364
	COURSE CREDITS	2
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
NIL	4	NIL	NIL	25	50	NIL	75

PRE-REQUISITE : CH231: Heat Transfer, CH342: Separation Process

COURSE OBJECTIVES :

CH364.CEO.1: Illustrate the basis of chemical engineering softwares such as Aspen HYSIS.
CH364.CEO.2: Learn the application of simulation software for solution of engineering problems.
CH364.CEO.3: Construct a bridge between manual calculation and computer simulation.
CH364.CEO.4: Develop an ability to effectively use computational techniques to solve chemical engineering problems.

COURSE OUTCOMES :

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

CH364.CO.1: Identify the operation/process required to solve an engineering problem.
CH364.CO.2: Match manual calculation with computer simulation.
CH364.CO.3: Apply the knowledge of chemical engineering basics to computational techniques.
CH364.CO.4: Categorize different types of equipments based upon application.
CH364.CO.5: Assess complex chemical engineering problems.
CH364.CO.6: Evaluate a chemical engineering process/plant.

PRACTICAL		
PRACTICAL NO.01	**Introduction**	**2 HOURS**
Introduction to Aspen HYSYS(Fluid Package & Component Addition)		
PRACTICAL NO.02	**Software Tools & Basic Component Drawing**	**2 HOURS**
Interface of Software: Different tools available,Basic Component & commands		
PRACTICAL NO.03	**Refrigeration Cycle**	**6 HOURS**
Propane Refrigeration Cycle, Industrial Application		
PRACTICAL NO.04	**Refrigerated Gas Plant**	**6 HOURS**
Refrigerated Gas Plant,Logical operation in Hysys,Interconnection of different equipments		
PRACTICAL NO.05	**Optimization by Simulation**	**4 HOURS**
Simulation & optimization of process parameters in given process flowsheet		
PRACTICAL NO.06	**Natural Gas Sweetening**	**4 HOURS**
Refinery operation process for purification(Sweetening) of natural gas using amine		
PRACTICAL NO.07	**Natural Gas Fractionation**	**6 HOURS**
NGL fractionation train(Introduction to industry application, requirement, and problem statement), Quiz based on last two sessions		
PRACTICAL NO.08	**Glycol Dehydration**	**6 HOURS**
Glycol dehydration process(utilization and application in industry), practical example based on project already executed by Chemsys		
PRACTICAL NO.09	**Distillation**	**4 HOURS**
Case studies on Azeotropic & Extractive Distillation		
PRACTICAL NO.10	**Chemical Products**	**4 HOURS**
Simulation Case studies on Urea/H2SO4/Methanol /Ethylene Manufacturing		
PRACTICAL NO.11	**Liquifaction of LNG**	**4 HOURS**
Simulation Case studies on Liquified Natural Gas		
PRACTICAL NO.12	**Project**	**12 HOURS**
Students will be given the ProjectTopics /Case Studies related to Chemical Engineering Problems. They are supposed to prepare flow sheet & solve the problem by using Aspen HYSIS Software		

TEXT BOOKS

1. Aspentech Getting Started Aspen Hysys V8 Manual.
2. Process Simulation using Hysys V8 by Ahmed Deyab fares.

REFERENCE BOOKS

1. I. M. Kamal, A.L. Malah Aspen Plus Chemical Engineering Applications Wiley Publication (ISBN: 9781119293620).
2. G. Rodriguez, A. Leguizamon, Process Analysis & Simulation in Chemical Engineering, Springer Publication, (ISBN:9783319148120).
3. A. K. Jana Process Simulation And Control Using Aspen, PHI Publications, (ISBN:9788120336599).

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2021 - 2022 (Rev. 2019)
THIRD YEAR BACHELOR OF TECHNOLOGY IN CHEMICAL ENGINEERING	**COURSE NAME**	Project Implementation
	COURSE CODE	CH365
	COURSE CREDITS	2
RELEASE DATE : 01/07/2021	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	ICE	ECE	IA			
NIL	4	NIL	NIL	NIL	NIL	75	75

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH365.CEO.1: To understand latest techniques, algorithms, models and design process in the field of project

CH365.CEO.2: To implement/develop/experiment/simulate techniques, algorithms and processes in software and real time

CH365.CEO.3: To upskill in quality technical writing and related tools for project documentation.

COURSE OUTCOMES :

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

CH365.CO.1: Analyze techniques, algorithms and design process relate to the project

CH365.CO.2: Implement/develop/experiment/simulate/test techniques/process and infer conclusions from it.

CH365.CO.3: Cognize the importance of documentation and report writing.

COURSE ABSTRACT

The project is most important part of undergraduate curriculum and enables students to develop analytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation.

To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Project Design, Project Implementation and Project Evaluation.

After successful completion of project design phase in Sem V (project design), next step is project implementation (Sem VI). The goal of this phase of the project is to implement/develop/experiment/simulate/test the techniques/processes of the project and give a mature shape. The implementation can be a combination of algorithms, techniques, processes, testing etc. This will also include drawing inferences from the results and discussing them.

GUIDELINES

1. Preferably project group students of Sem V would be continued in this semester VI.
2. Every project group should consist of minimum 03 and maximum of 04 students.
3. The group members may be from different programs to support the interdisciplinary functioning.
4. Project group members and title of the project need to be approved by Project Guide and School.
5. Projects should preferably have a national/international, industry/academic/research collaboration.
6. User Oriented Collaborative Design: The students need to identify the problem by discussion with various stakeholders, site visits, expert-opinions and various research articles.
7. The relevance and criticality of the problem to be solved, need to be established by collecting sufficient information and background study.
8. Define proposed solution and apply project management/modeling tools for project planning and design.
9. Define outcome, milestones, definite roadmap for project design, implementation, tools, resources, performance evaluation and documentation.
10. Perform refinement of System architecture & methodology.
11. Students should give a mature shape to their idea in terms of implementation. This is expected in this semester. This may include one or many of these points. Implementation /development/experimentation/simulation/testing/building the techniques/processes

COLLABORATIVE/SPONSORED PROJECT

1. Students are encouraged to take real time problems from national/international industry/academic/research organizations of repute (like NCL, BARC, IISER, DRDO, CDAC, etc) for project work.
2. Project statement, scope of the work, objectives and final outcomes must be decided and approved by faculty mentor and collaborative organization at the start of semester VI.
3. Proposed Collaborative Project work need to be reviewed by team of faculty reviewers to ensure assigned work is equivalent to the final undergraduate project work of 12 months.
4. Final assessment will be carried out in presence of faculty mentor, external mentor and examiner.

TIMELINE

1. Freezing of project groups and titles. Refinement of title and objectives from Sem V should freezed by the time of first review.
2. Final Synopsis of the project. (To be done at guide level)
3. Methodology / System Design / Block Diagram should be properly explained by the student
4. Project Review I Presentation.
5. Project Implementation: Students should take the work in one and/more of the points. Like Implementation/development/experimentation/simulation/testing/experimental yield/building the techniques/processes etc
6. Based on the points discussed in 5, student would be able to get results and discuss them. Students should be able to draw inferences from results.
7. Project Review II Presentation.
8. Quality of Publication and Researchers: Students would be educated on different technical papers and their importance (article types, journal metrics etc) along with author/researcher credentials.
9. Project Documentation: Project Report Writing

ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Project Review I: Problem Statement and objectives, Implementation plan & action (algorithms/techniques/models/mathematical understanding/implementation) (10 Marks)
2. An activity on illustrating methodology. This may inlcude paper reading activity: Read and Summarize a paper in 1 page (Individual to every student of the group). Any other activity can also be taken take would illustrate methodology (10 marks)
3. Project Review II: Results and Implementation, Observations, Inferences, Discussion on algorithms / techniques /models / testing) (10 Marks)
4. Article Quality and Author Credentials: Information about Research Article types, paper quality metrics (SCI/SCOPUS/WOS) and Author Credentials (Citation count, h-index, I10 index etc) (5 marks)
5. Project Report (10 Marks)
6. Project: Documentation Final Presentation and Demonstration (30 Marks)

(Parameters of evaluation: Final implemented work, report, presentation and paper drafted based on work)

REFERENCES

1. Eng-Choon Leong et al, "Guide To Research Projects For Engineering Students", CRC press, Apple Academic Press Inc. ISBN: 9781482238778, 9781482238778.
2. Larsen Samuel Bruning, "Doing Projects And Reports In Engineering", Macmillan Education UK, Bloomsbury Publishing PLC, 2019, ISBN: 9781352005639, 1352005638.
3. Michelle Reid, "Report Writing (Pocket Study Skills)", Second Edition, Macmillan Education.
4. Sara Efrat Efron and Ruth David, "Writing the Literature Review: A Practical Guide", Guilford Press, ISBN-13: 978-1462536894.
5. Helmut Kopka and Patrick Daly, "A Guide to Latex: Document preparation for beginners and advanced users", Addison Wesley, 1999.

MIT | Academy of Engineering

MIT ACADEMY OF ENGINEERING, ALANDI

An Autonomous Institute Affiliated to

Savitribai Phule Pune University

Curriculum

For

Final Year

Bachelor of Technology in Chemical Engineering

2019-2023

(With Effect from Academic Year: 2022-2023)

MIT | Academy of Engineering Autonomous Institute Affiliated to SPPU	COURSE STRUCTURE (2019 - 2023)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2022-2023
FINAL YEAR BACHLEOR OF TECHNOLOGY IN CHEMICAL ENGINEERING	RELEASE DATE	:	01/07/2022
	REVISION NO.	:	1.0

SEMESTER: VII

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
DC14	CH461	Plant Design and Piping	1	4	-	0	30	20	50	25	125	3
DE01	CH48#	Refer Annexure	3	0	-	35	35	30	0	0	100	3
OE03	CH471 / CH472	Process Intensification and Integration / Energy Management and Audit	3	2	-	35	35	30	50	0	150	4
SDP11	CH463	Skill Development Lab (Aspen EDR)	0	4	-	0	0	25	50	0	75	2
SDP12	CH470	Project Evaluation	0	8	-	0	0	50	0	100	150	4
SDP13	CH400	Summer Internship	-	-	-	-	-	-	-	150	150	4
TOTAL			**7**	**18**	**0**	**70**	**100**	**155**	**150**	**275**	**750**	**20**

SEMESTER: VIII (PART A)

COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
DC15	CH462	Chemical Equipment Design II	3	2	-	35	35	30	50	0	150	4
DE02	CH49#	Refer Annexure	3	0	-	35	35	30	0	0	100	3
HSS7	HP405	Engineering Economics	2	0	-	0	50	25	0	0	75	2
HSS8	HP406	Psychology	2	0	-	0	50	25	0	0	75	2
SDP14	CH480	Capstone Work	-	8	-	0	0	50	0	100	150	4
TOTAL			**10**	**10**	**0**	**70**	**170**	**160**	**50**	**100**	**550**	**15**

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	COURSE NAME	Plant Design and Piping
	COURSE CODE	CH461
	COURSE CREDITS	3
RELEASE DATE : 01/07/2022	REVISION NO	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
1	4	0	30	20	50	25	125

PRE-REQUISITE : CH363: Chemical Process Technology

COURSE OBJECTIVES :

CH461.CEO.1: Introduction to plant design and piping.
CH461.CEO.2: Understand the basis of chemical engineering software Pro simulator/Pro-pipe.
CH461.CEO.3: Learn the application of simulation software for solution of engineering problems.
CH461.CEO.4: Make operational awareness in the industrial process plant.
CH461.CEO.5: Identify troubleshoots in chemical process plant.
CH461.CEO.6: Learn fundamentals of piping design and construction.

COURSE OUTCOMES :

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

CH461.CO.1: Identify the operation/process required to solve an engineering problem.
CH461.CO.2: Complete conceptual or preliminary plant design.
CH461.CO.3: Analyze the basic instrumentation troubleshooting system.
CH461.CO.4: Design a piping layout and construction.
CH461.CO.5: Apply the knowledge of chemical engineering basics to computational techniques.
CH461.CO.6: Assess complex industrial refineries problems.

PRACTICAL		
PRACTICAL NO.01	**Study on Operability of Cement Process Plant**	**4 HOURS**
The primary objective Basic Cement Plant Program is to learn the operating fundamentals of a Cement Plant using dynamic simulation. The study on system monitoring and controlling of complete process plant.		
PRACTICAL NO.02	**Study on Operability of Ammonia Process Plant**	**4 HOURS**
Ammonia Synthesis Program is to learn the operating fundamentals of an Ammonia Synthesis Unit using dynamic simulation - to startup and shutdown the process. The study on system monitoring and controlling of complete process plant.		
PRACTICAL NO.03	**Study on Operability of Sulphuric Acid Process Plant**	**4 HOURS**
The primary objective of Sulphuric Acid Plant model is to learn the operating fundamentals of the Sulphuric Acid plant using dynamic simulation. The study on system monitoring and controlling of complete process plant.		
PRACTICAL NO.04	**Study on Operability of Crude Distillation Unit**	**4 HOURS**
Fundamentals of a Crude Distillation Unit using dynamic simulation. Pro Simulator provides opportunities to identify the main equipments associated with a Crude Distillation Unit, to describe the operations of a Crude Distillation Column. The study on system monitoring and controlling of complete process plant.		
PRACTICAL NO.05	**Study on Operability of Vacuum Distillation Unit**	**4 HOURS**
The primary objective of Vacuum Distillation Unit Plant Program is to learn the operating fundamentals of the plant using dynamic simulation. The study on system monitoring and controlling of complete process plant.		
PRACTICAL NO.06	**Study on Basic Instrumentation Troubleshooting System**	**4 HOURS**
The basic instrumentation troubleshooting system - dynamically simulates the control system. The study on controlling of basic instrumentation.		
PRACTICAL NO.07	**Study on Piping Design and Layout**	**4 HOURS**
Pipe line Size Selection and Layout, Piping Insulations, Modeling of Piping Plan and general drawings, etc.		
PRACTICAL NO.08	**Study on Piping Cost Analysis**	**4 HOURS**
Costing and piping systems		
PRACTICAL NO.09	**Study on Piping supports and Stress Analysis**	**4 HOURS**
Piping supports and span calculations, Stress and strain diagrams, Reinforcements, etc.		
PRACTICAL NO.09	**Industry 4.0 for Process Engineering**	**4 HOURS**
Tools and Systems in Industry 4.0 specially crafted for Process Industry, Data Analytics/Modeling, Deep Learning using Artificial Neural Networks, etc.		

TEXT BOOKS

1. Warren D. Seider, J. D. Seader, Daniel R. Lewin, Product and Process Design Principles: Synthesis, Analysis, and Evaluation, 2nd Edition, Wiley, ISBN: 9781119282631.
2. Richard Turton, Joseph A. Shaeiwitz, Debangsu Bhattacharyya, Wallace B. Whiting, Analysis, Synthesis and Design of Chemical Processes, 5th Edition, Prentice Hall, 2018, ISBN: 0134177657, 9780134177656.

REFERENCE BOOKS

1. Johnstone and Thring," Pilot Plants Models and Scale-up methods in Chemical Engg.", McGraw Hill, New York, 1962.
2. Coulson and Richardson's Chemical Engineering, Vol. 6: Chemical Engineering Design. By R.K. Sinnott, Butterworth-Heinemann, Oxford, 3rd, Ed., 1999, 1994.
3. Brannan, C., Rules of Thumb for Chemical Engineers, 4th Ed., Gulf Professional Publishing, Burlington, MA, 2005.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Petroleum Refining Technology
	COURSE CODE	CH483
	COURSE CREDITS	3
RELEASE DATE : 01/07/2022	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	35	35	30	NIL	NIL	100

PRE-REQUISITE : CH233: Mass Transfer, CH342: Separation Process

COURSE OBJECTIVES :

CH483.CEO.1: Explain the market drivers for the refining industry.
CH483.CEO.2: Understand composition and characteristics of crude oils.
CH483.CEO.3: Understand various test for petroleum products.
CH483.CEO.4: Classify the processes used in petroleum refining.
CH483.CEO.5: Sketch a flow diagram that integrates all refining processes and the resulting refinery products.
CH483.CEO.6: Examine implications of changing crude oil feedstock on refinery configuration.

COURSE OUTCOMES :

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

CH483.CO.1: Apply characteristics of crude oil for classification and separation .
CH483.CO.2: Analyze the importance of pre refining operation.
CH483.CO.3: Interpret specification and test methods for fuel.
CH483.CO.4: Identify processes used in refinery with its importance.
CH483.CO.5: Build Hydrogen and sulphur production Flowsheet.
CH483.CO.6: Interpret Lube oil and Bitumen production Flowsheet and specification.

THEORY COURSE CONTENT		
UNIT 1	**Introduction and Crude Oil Composition**	**7 HOURS**
Indian Petroleum Industry: World and Indian and scenario of petroleum industry, major companies. World production, Markets, Offshore and onshore. Composition of Crude: Classification, Evaluation of petroleum, UOP-k factor, TBP analysis, EFV analysis, Average boiling point, ASTM curves, Thermal properties of petroleum fractions, Transportation of crude oil.		
UNIT 2	**Pre - refining and Distillation**	**7 HOURS**
Pre-refining operations such as Settling, Moisture removal, Desalting, Storage, Heating through exchangers and pipe still heaters, Atmospheric distillation, Vacuum distillation.		
UNIT 3	**Testing and Specification of Product**	**7 HOURS**
Gas: Various types of gas and LPG. Gasoline and Naphtha: Octane No, Reid vapor pressure analysis, Oxidation stability, Additives used.. Kerosene: Smoke Point, Flash point or fire point, volatility, burning qualities etc. Diesel: Cetane No, viscosity etc, Grades of diesels e.g. HSD, LDO, Diesel additives. Lube oils: Types, tests-carbon residue and viscosity index. Bitumen and Wax: Softening point, Ductility, Penetration test, Dielectric test.		
UNIT 4	**Process in Refinery**	**7 HOURS**
Catalytic & thermal cracking, reforming and coking, Fluid Catalytic Cracking, alkylation, isomerisation.		
UNIT 5	**Hydrogen and Sulphur Management**	**7 HOURS**
Hydrodesulphurization, Hydro-cracking, Hydrogen Management: Production and recovery, Sulphur Recovery.		
UNIT 6	**Lube oil, Bitumen**	**7 HOURS**
Lube oil production, deasphalting, Solvent extraction, dewaxing, Finishing operations, Lube oil additives. Manufacture of Bitumen. Environmental Pollution aspects in refinery.		

TEXT BOOKS

1. Bhaskara Rao. B.K., Modern Petroleum Refining Process, 3rd Edition, Oxford & IBH, New Delhi, 1984.
2. Ram Prasad, Petroleum Refining Technology, 1st Edition, Khanna Publishers, 2000.
3. Gary, J. & Handwerk, G. Petroleum Refining Technology, 4th Edition, Marcel Dekker, Inc., New York, Basel , ISBN: 0824704827.
4. David S. J. Stan Jones. Handbook of Petroleum Processing, by Institute of Petroleum (IP), John Wiley, ISBN: 9780470850220.

REFERENCE BOOKS

1. Dawe R. A., Modern Petroleum Technology Part I, by Institute of Petroleum (IP), John Wiley, ISBN: 9780470850213.
2. Kirk & Othmer, Concise Encyclopedia of Chemical Technology, 5th Edition, Wiley Publishers, 2007, ISBN 9780470047484.
3. Faith W.L, Lowenheim F.A, Moran M.K, Industrial Chemicals, 4th Edition, Wiley Publishers, ISBN 9780471549642.
4. Groggins P.H, Unit process in organic synthesis, 5th Edition, McGraw Hill, 2004, ISBN 9780074621431.
5. Speight J G, The Chemistry and technology of petroleum, CRC Press, ISBN 9781439873892.
6. Myers, Handbook of Petroleum Processing, McGraw-Hill Education. ISBN: 9780071391092.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Biochemical Engineering
	COURSE CODE	CH484
	COURSE CREDITS	3
RELEASE DATE : 01/07/2022	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	NIL	35	35	30	NIL	NIL	100

PRE-REQUISITE : CH343: Chemical Reaction Engineering

COURSE OBJECTIVES :

CH484.CEO.1: Provide basic knowledge of biochemical engineering.
CH484.CEO.2: Understand the kinetics of enzymes.
CH484.CEO.3: Learn techniques and industrial applications of enzymes.
CH484.CEO.4: Relate Cell Kinetics study and design of fermentor.

COURSE OUTCOMES :

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

CH484.CO.1: Identify basics of biology and overview of biotechnology.
CH484.CO.2: Model cell and enzyme kinetics.
CH484.CO.3: Apply methods of immobilization.
CH484.CO.4: Illustrate sterilization methods.
CH484.CO.5: Inspect bio-product recovery & bio-separations for biochemical Products.
CH484.CO.6: Design, analyse and check the stability of bioreactors.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Biochemical Engineering**	**7 HOURS**
Basics of Biology: Overview of Biotechnology; Diversity in Microbial Cells, Cell Constituents, Chemicals for Life.Applications of biotechnology in day to day life .		
UNIT 2	**Fermentation Aspects**	**7 HOURS**
Fermentation Types of mechanisms, Continuous fermentation aeration and agitation, kinetics of fermentation Processes.Basics of fermentor.		
UNIT 3	**Enzyme Kinetics**	**7 HOURS**
Introduction, Simple Enzyme Kinetics, Enzyme Reactor with Simple Kinetics, Inhibition of Enzyme Reactions, and Other Influences on Enzyme Activity. Immobilized Enzymes: effects of intra and interphase mass transfer on enzyme kinetics.		
UNIT 4	**Metabolic Study**	**7 HOURS**
Major Metabolic Pathways: Bioenergetics, Glucose Metabolism, Biosynthesis. Microbial Growth: Continuum and Stochastic Models.		
UNIT 5	**Sterilization**	**7 HOURS**
Sterilization: Sterilization methods, thermal death kinetics, design criterion, batch sterilization, continuous sterilization and air sterilization. Downstream Processing: introduction, solid-liquid separation, cell rupture, recovery and purification.		
UNIT 6	**Bioreactor Design**	**7 HOURS**
Introduction of Bioreactor design: Continuously stirred aerated tank bioreactors. Mixing power correlation. Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on oxygen transfer rate. Bio-product Recovery and Bio-separations, Manufacture of Biochemical Products.		

TEXT BOOKS

1. Technological Applications of Bio-catalysts, BIOTOL series, Butter worth, 1995, ISBN: 9780750605069.
2. Cornish A. Bowden, Analysis of Enzyme Kinetic Data, Oxford University Press, 1996, ISBN: 0736034625444.

REFERENCE BOOKS

1. Biochemical Engineering Fundamentals by J. E. Bailey & D. F. Ollis, McGraw Hill Book Company, 1986, (ISBN: 9780070701236).
2. Lee J.M., Biochemical Engineering, Ebook, version 2.32, 2009, (ISBN: 9783527318506).
3. James E. Bailey & David F. Ollis, Biochemical Engineering Fundamentals, 2 nd edition, McGraw Hill International, 1986, (ISBN: 9780070032125).
4. Michael L. Shuler & Fikret Kargi, Bioprocess Engineering Basic Concepts, 2 nd edition, Prentice Hall of India, New Delhi, 2002, (ISBN: 9788120321106).
5. Wiseman A (Ed.), Topics in enzyme and fermentation Bio-technology, Ellis mand Harwood, U.K. Vol-5, (ISBN: 9885177332121).

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Environmental Engineering
	COURSE CODE	CH485
	COURSE CREDITS	3
RELEASE DATE : 01/07/2022	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	35	35	30	NIL	NIL	100

PRE-REQUISITE : CH233: Mass Transfer, CH341: Chemical Engineering Operations

COURSE OBJECTIVES :

CH485.CEO.1: Acquire knowledge about the importance of environment and environmental standards.
CH485.CEO.2: Ability to work & learn effectively on environmental issues such as air pollution.
CH485.CEO.3: Develop skills of design of control devices for air pollution.
CH485.CEO.4: Ability to apply quantitative reasoning skills to environmental problems including basic calculations related to water quality parameters.
CH485.CEO.5: Ability to work effectively on complex problem of waste water treatment.
CH485.CEO.6: Describe the impact of solid waste on land.

COURSE OUTCOMES :

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

CH485.CO.1: Understand the importance of environment and environmental standards.
CH485.CO.2: Identify the sources of Air pollution & suggest the steps to mitigate air pollution.
CH485.CO.3: Specify control devices for air pollution.
CH485.CO.4: Understand the different wastewater.
CH485.CO.5: Identify tools and techniques for tertiary waste water treatment.
CH485.CO.6: Understand the different strategies for solid waste management.

THEORY COURSE CONTENT		
UNIT 1	**Introduction**	**6 HOURS**
An overview of environmental engineering, pollution of air, water and soil, impact of population growth on environment, environmental impact of thermal, hydro and nuclear energy, chemical pollution, solid wastes, prevention and control of environmental pollution, water and air pollution laws and standards, clean development mechanisms (CDM), Kyoto protocol. Plum behavior.		
UNIT 2	**Air Pollution**	**6 HOURS**
Definition of air pollution, sources scales of concentration and classification of air pollutants. Effects of air pollutants on human health, plants, animals, materials, Economic effects of air pollution, sampling and measurement of air pollutants, air pollution control standards: WHO, BIS, MPCB, CPCB.		
UNIT 3	**Air Pollution Control Methods and Equipment**	**6 HOURS**
Particulate pollution: cleaning methods, collection efficiency, particulate collection systems, Basic design, stack height and operating principles of settling chamber, cyclone separator, fabric filter, electrostatic precipitator. Operating principles of spray tower, centrifugal scrubber, venturi scrubber, selection of particulate collector. Gaseous pollution: Principles of control by absorption, adsorption, combustion or catalytic oxidation, removal of SOx, NOx. Numerical problems based on the theory.		
UNIT 4	**Water Pollution and Wastewater Treatment**	**6 HOURS**
Domestic and industrial wastewater, types, sources and effects of water pollutants. Waste water characteristicsDO, BOD, COD, TOC, total suspended solids, colour and odour, bacteriological quality, oxygen deficit, determination of BOD constants. Water quality standards: ICMR, WHO, MPCB and CPCB. Principles of primary treatment and secondary treatment, process design and basic operating principles of activated sludge (suspended growth) process, sludge treatment and disposal, trickling filter. Advanced methods of waste water treatment: UASB, photo catalytic reactors, wet-air oxidation, and biosorption.		
UNIT 5	**Tertiary Water Treatment**	**6 HOURS**
Tertiary treatment: disinfection by chlorine, ozone and hydrogen peroxide, UV rays, recovery of materials from process effluents, micro-screening, biological nitrification and denitrification, granular medium filtration, membrane separation processes, ion exchange.		
UNIT 6	**Land Pollution and Solid Waste Management**	**6 HOURS**
Land Pollution: Sources and classification of solid wastes, disposal methods, incineration, composting, recovery and recycling. Plastic waste management, e-waste management, ISO 1401, ISO 2015, Environmental Impact Assessment (EIA).		

TEXT BOOKS

1. Rao C. S. Environmental Pollution Control Engineering, Wiley Eastern Publications, (ISBN:0470217634).
2. R. W. Gaikwad and R. S. Sapkal, Environmental Engineering, Denett & Co, (ISBN: 9788190322836).

REFERENCE BOOKS

1. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill, New Delhi, (2006).2nd edition, (ISBN: 9780070648135).
2. Rajagopalan, R, Environmental Studies-From Crisis to Cure, Oxford University Press, Third Edition, (ISBN: 9780199459759).
3. G. Kiely, Environmental Engineering, McGraw Hill 1997, (ISBN: 9780071164245).
4. Gilbert M.Masters, Introduction to Environmental Engineering and Science, 3rd edition, Pearson Education (2004), (ISBN:9780131481930).

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	COURSE NAME	Process Intensification and Integration
	COURSE CODE	CH471
	COURSE CREDITS	4
RELEASE DATE : 01/07/2022	REVISION NO	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH362: Chemical Equipment Design I

COURSE OBJECTIVES :

CH471.CEO.1: Examine the concept of process integration and intensification.
CH471.CEO.2: Consider the reactor synthesis and reaction network in process industries.
CH471.CEO.3: Estimate the minimum utility targets.
CH471.CEO.4: Study heat and mass integration.
CH471.CEO.5: Study water pinch analysis.
CH471.CEO.6: Learn process intensified equipments and features.

COURSE OUTCOMES :

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

CH471.CO.1: Apply the concept of process integration and intensification.
CH471.CO.2: Interpret the pinch analysis and methodology.
CH471.CO.3: Apply process integration approach to given process.
CH471.CO.4: Identify bottlenecks in process for minimization of energy requirements.
CH471.CO.5: Design optimal process route.
CH471.CO.6: Synthesize the reactor with given process requirements.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Process Integration**	**6 HOURS**
Process Integration (PI), A brief history of the development of Process Integration, Various aspects of PI, Techniques available for PI, Basic concept of process design & onion diagram, Concept of pinch analysis for maximizing energy efficiency, Problem addressed by pinch technology and energy savings, Pinch Technology and targeting Heat Recovery: the thermodynamic roots.		
UNIT 2	**Synthesis of Reactor Networks Design**	**6 HOURS**
Objectives, Reaction models / types of reactors, Reaction kinetics, Locating the Separation Section with Respect to the Reactor Section, Optimal Reactor Conversion, Reactor Design for Complex Configurations, Reactor Network Design Using the Attainable Region. Heat integrated in distillation operations and sequences.		
UNIT 3	**Synthesis of Heat Exchange Networks**	**8 HOURS**
Objectives, Heat integration, Basic Heat Exchange Network Synthesis (HENS), Minimum Utility Targets, Temperature Interval Method, Hohmann / Lochart Composite Curves (HCC), Grand Composite Curves (GCC), Pinch Design Approach to Inventing a Network, Networks for Maximum Energy Recovery, Minimum Number of Exchangers, Stream Splitting, Threshold and Optimum Approach Temperature.		
UNIT 4	**Synthesis of Mass Exchange Networks**	**8 HOURS**
Objectives, Minimum Mass Separating Agent, Minimum Number of Mass Exchangers, Cost optimization of minimum composition approach, Graphical approach to targeting of Mass Exchange Network Synthesis (MENS), Composition Interval Diagram (CID), Algebraic approach to targeting of MENS.		
UNIT 5	**Synthesis of Water Design Networks**	**7 HOURS**
Objectives, Water pinch analysis, Industrial water usage and operations, Water management and minimization, Targeting maximum water reuse for single contaminants, Design for maximum water reuse for single contaminants, Targeting minimum wastewater treatment for single contaminants, Network water design.		
UNIT 6	**Introduction to Process Intensification**	**7 HOURS**
Brief history of Process intensification (PIs), Applications and its benefits of PIs, Process intensifying equipments and methods, Techniques of process intensification application case studies on reactive separations, intensive mixing and novel reactors etc.		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Heat integration in distillation operation		
PRACTICAL NO.02		**2 HOURS**
Process heat recovery in sour water stripping process		
PRACTICAL NO.03		**2 HOURS**
Heat exchange pinch analysis		
PRACTICAL NO.04		**2 HOURS**
Heat Exchanger Network		
PRACTICAL NO.05		**2 HOURS**
Synthesis of mass exchange networks		
PRACTICAL NO.06		**2 HOURS**
Synthesis of water pinch network		
PRACTICAL NO.07		**2 HOURS**
Intensification of mass transfer operation - Divided wall distillation		
PRACTICAL NO.08		**2 HOURS**
Intensification of reactive separation system - Reactive distillation		
PRACTICAL NO.09		**2 HOURS**
Process integration and intensification for petrochemical plant - Case study		
PRACTICAL NO.10		**2 HOURS**
Process integration and intensification in pharmaceutical industries Case study		

TEXT BOOKS

1. Mahmoud M. El-Halwagi, Process Integration-Process Systems Engineering, Volume 7, Academic Press, 2006, ISBN: 9780123705237.
2. R. Smith, Chemical Process: Design and Integration, 1st Edition, Wiley, 2005, ISBN: 9781118699096.
3. David Reay, Colin Ramshaw, Adam Harvey, Process Intensification, 2nd Edition, Butterworth Heinemann, 2008, ISBN: 9870080983042.

REFERENCE BOOKS

1. Ian C. Kemp, Pinch Analysis and Process Integration: A User Guide on Process Integration, 2nd Edition, Butterworth Heinemann, Elsevier, 2007, ISBN: 9780750682602.
2. Stankiewicz, A. and Moulijn,Re-engineering the Chemical Process Plants, Process Intensification, Marcel Dekker, 2003, ISBN: 0203913299.
3. U. V. Shenoy, Heat Exchanger Network Synthesis: Process Optimization by Energy and Resource Analysis, Gulf Professional Publishing, 1995 ISBN: 0884153916.
4. Warren D. Seider, J. D. Seader, Daniel R. Lewin, Product and Process Design Principles: Synthesis, Analysis, and Evaluation, 2nd Edition, Wiley, ISBN: 978111928263.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Energy Management and Audit
	COURSE CODE	CH472
	COURSE CREDITS	4
RELEASE DATE : 01/07/2022	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH352: Energy Engineering

COURSE OBJECTIVES :

CH472.CEO.1: Learn to conserve energy through planning and management.
CH472.CEO.2: Understand Energy Audit procedure along with relevant technologies/tools.
CH472.CEO.3: Develop Energy Audit Report writing skills.
CH472.CEO.4: Improve the thermal efficiency by designing suitable systems for heat recovery and co-generation.

COURSE OUTCOMES :

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

CH472.CO.1: State the need for energy management and audit.
CH472.CO.2: Execute proper energy management and planning.
CH472.CO.3: Carry out the cost- benefit analysis of various investment alternatives for meeting the energy needs.
CH472.CO.4: Design suitable energy monitoring system to analyze and optimize the energy consumption.

THEORY COURSE CONTENT		
UNIT 1	**Energy Management**	**7 HOURS**
Two sides of energy management, sectors of supply side energy management, objectives, hierarchy, trade-off between energy and environment, energy and economy, transportation of energy, per capita energy consumption, energy management and control systems, energy management in end user plant, seven principles of energy management, organization for energy management, Energy Exergy concept.		
UNIT 2	**Energy Planning**	**7 HOURS**
Energy strategies and energy planning, essential imperatives and steps in supply side energy planning, energy planning flow for supply side, essential data, infrastructure planning, essential imperatives and steps in user side energy planning.		
UNIT 3	**Energy Audit**	**7 HOURS**
Introduction, Types of energy audits, walk through energy audit, intermediate energy audit, comprehensive energy audit, end use energy consumption profile, procedure of energy auditing, composition of comprehensive audit team, data for comprehensive audit, site testing and measurement .		
UNIT 4	**Energy Balance & MIS**	**7 HOURS**
First law of efficiency and Second law of efficiency, Facility as an Energy system, Methods forpreparing process flow, Materials and Energy Balance diagram, Identification of losses, improvements, Energy Balance sheet and Management Information System (MIS), Energy Modeling and Optimization.		
UNIT 5	**Energy Monitoring, Targeting Review and Evaluation**	**7 HOURS**
Definition Monitoring and targeting, elements of monitoring and targeting, data andinformation analysis, techniques energy consumption, production, cumulative sum ofdifference (CUSUM), Review and evaluation.		
UNIT 6	**Energy Policy**	**7 HOURS**
Need for Energy Policy for Industries, Formulation of Policy by any industrial Unit,Implementation in Industries, National & State level Policies.		

PRACTICAL		
PRACTICAL NO.01	**Case Study on Audit Report of Industry**	**4 HOURS**
Prepare audit report for Chemical Industry		
PRACTICAL NO.02	**Case Study on Energy Analyzer**	**4 HOURS**
Prepare report on energy analyzer for any process industry through software		
PRACTICAL NO.03	**Case Atudy on Analyzer Star Labeled Apparatus**	**4 HOURS**
Analyze star labeled electrical apparatus and compare the data sheet (Pamphlet) of various star ratings		
PRACTICAL NO.04	**Case Study on Energy Saving**	**4 HOURS**
Determine Net Energy Saving by Lamp replacements		
PRACTICAL NO.05	**Case study on Energy Conservation**	**4 HOURS**
Determine Energy conservation in Fan by using Electronic Regulator		

TEXT BOOKS

1. Rao S., Parulekar B. B., Energy Technology Nonconventional, Renewable and Conventional, Khanna Publishers, 3rded.1999, ISBN: 8174090401.
2. Murphy W. R., McKay G., Energy Management, Butterworth and Co. publishers, Elsevier, 1982, ISBN No. 9780408005081.

REFERENCE BOOKS

1. C.B.Smith, Energy Management Principles, Pergamon Press.
2. W.C. Turner, Energy Management Handbook, John Wiley and Sons, A Wiley Interscience Publication.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Skill Development Lab (Aspen EDR)
	COURSE CODE	CH463
	COURSE CREDITS	2
RELEASE DATE : 01/07/2021	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
NIL	4	NIL	NIL	NIL	50	25	75

PRE-REQUISITE : CH231: Heat Transfer, CH364: Skill Development Lab (Aspen ONE)

COURSE OBJECTIVES :

CH463.CEO.1: Understand the basis of chemical engineering softwares such as Aspen EDR.
CH463.CEO.2: Learn the application of simulation software for solution of engineering problems.
CH463.CEO.3: Make aware about the chemical engineering concepts in efficient problem solving.
CH463.CEO.4: Construct a bridge between manual calculation and computer simulation.
CH463.CEO.5: Develop an ability to effectively use computational techniques to solve chemical engineering problems.
CH463.CEO.6: Learn the design aspects of chemical process plant.

COURSE OUTCOMES :

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

CH463.CO.1: Identify the operation/process required to solve an engineering problem.
CH463.CO.2: Match manual calculation with computer simulation.
CH463.CO.3: Apply the knowledge of chemical engineering basics to computational techniques.
CH463.CO.4: Categorize different types of equipments based upon application.
CH463.CO.5: Assess complex chemical engineering problems.
CH463.CO.6: Design a chemical engineering process/plant.

PRACTICAL		
PRACTICAL NO.01	**Introduction**	**2 HOURS**
Introduction to ASPEN HYSYS Exchanger and Design Rating		
PRACTICAL NO.02	**Awareness for Software Tools and Basic Components**	**2 HOURS**
Interface of Software: Different tools available, Basic Component & commands		
PRACTICAL NO.03	**Shell & Tube Heat Exchanger Design**	**2 HOURS**
Stepwise Aspen Simulation of Shell & Tube Heat Exchanger Design		
PRACTICAL NO.04	**Plate Exchanger Design**	**2 HOURS**
Aspen Simulation of Plate Exchanger Design		
PRACTICAL NO.05	**Air Cooled Exchanger**	**2 HOURS**
Aspen Simulation of Air Cooled Exchanger		
PRACTICAL NO.06	**Plate Fin Exchanger**	**2 HOURS**
Aspen Simulation of Plate Fin Exchanger		
PRACTICAL NO.07	**Fired Heater**	**2 HOURS**
Aspen Simulation of Fired Heater		
PRACTICAL NO.08	**Evaporator**	**2 HOURS**
Aspen Simulation of Evaporator		
PRACTICAL NO.09	**Evaporator Energy Management**	**2 HOURS**
Optimize energy use, predict and eliminate energy waste through use of an integrated design and modeling tool		
PRACTICAL NO.10	**Project**	**2 HOURS**
Students will be given the Project Topics / Case Studies related to Chemical Engineering Problems. They are supposed to prepare flow sheet & solve the problem by using Aspen HYSYS Software		

TEXT BOOKS

1. Aspentech Getting Started Aspen Hysys V8 Manual.
2. Ahmed Deyab Fares, Process Simulation using HYSYS V8.

REFERENCE BOOKS

1. I. M. Kamal, A.L. Malah Aspen Plus Chemical Engineering Applications Wiley Publication (ISBN: 9781119293620).
2. G. Rodriguez, A. Leguizamon, Process Analysis & Simulation in Chemical Engineering, Springer Publication, (ISBN:9783319148120).
3. A. K. Jana Process Simulation And Control Using Aspen, PHI Publications, (ISBN:9788120336599).

MIT | Academy of Engineering (An autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	AY: 2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY IN CHEMICAL ENGINEERING	COURSE NAME	Project Evaluation
	COURSE CODE	CH470
	COURSE CREDITS	4
RELEASE DATE : 01/07/2022	REVISION NO	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	ICE	ECE	IA			
NIL	8	NIL	NIL	NIL	NIL	150	150

COURSE OBJECTIVES :

CH470.CEO.1: To understand how to carry out performance evaluation and comparative analysis in appropriate form.

CH470.CEO.2: To know about standard industry practices.

CH470.CEO.3: To become familiar with the steps involved in identifying and selecting a good platform to present the work done.

COURSE OUTCOMES :

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

CH470.CO.1: Interpret findings, compare them with results in the literature, identify weaknesses and limitations, and propose improvements.

CH470.CO.2: Make use of standard industry practices.

CH470.CO.3: Decide appropriate platform for presenting the work done.

COURSE ABSTRACT

The project is most important part of undergraduate curriculum and enables students to develop an alytical, critical thinking, problem solving, and communication, cooperation, leadership skills. Project enable students to assimilate their learning to address a real-world interdisciplinary problems. The objective of undergraduate project is to analyze, design, implement, compelling solution to real world problems, and do performance evaluation with relevant documentation.

To enhance the effectiveness and achieve worthwhile outcome of engineering knowledge that the student has acquired, the entire project process is divided in three phases, viz., Project Design, Project Implementation and Project Evaluation.

After successful completion of project implementation (Sem VI), next step is project evaluation (Sem VII). The goal of this phase of the project is to draw Inferences and Detail Analysis/Final Testing/Re-development/etc. Showcasing the work - Technical documentation in Conferences/Journal/Patent/Product/Working model.

GUIDELINES

1. Project group students of Sem VI would be continued in this semester VII.
2. The group members may be from different programs to support the interdisciplinary functioning.
3. Projects should preferably have a national/international, industry/academic/research collaboration.
4. Students should do extended implementation of their project in consultation with their advisor.
5. For extended implementation, objectives of Sem V and Sem VI should have been already achieved.
6. Every project should follow at least one standard industry practice while implementing. For example, below are some of the standard industry practices followed by Electrical engineers:
   (a) If writing a Matlab code, follow **MathWorks Advisory Board (MAB)** Guidelines
   (b) For embedded c coding, **Motor Industry Software Reliability Association (MISRA)** standards can be used
   (c) If antenna is manufactured, then get **EMI/EMC** testing certificate from National Accreditation Board for Testing and Calibration Laboratories.
7. Performance evaluation and Comparative analysis of results should be carried out and presented in appropriate form.
8. Carry out detail analysis to improve performance w.r.t Final Testing/Re-development/etc.
9. Showcase the work in Conferences/Journal/Patent/Product/Working model.

Note: *For guideline 6, every school should identify standard industry practices and try to incorporate in the projects.*

ASSESSMENT and EVALUATION

The three member jury/committee will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the project guide. Assessment shall be done jointly by the guide and jury members.

1. Project Review I (Internal): (20 Marks)
2. Activity (Standard industry practices): (20 Marks)
3. Project Review II (External): (20 Marks)
4. Project Report: (20 Marks)
5. Every project group should publish paper in National conference / International conference / Participate in technical project competition (with achievement) / File a patent/etc.: (20 Marks)
6. Project: Final Presentation and Demonstration (External) (50 Marks)

Note:

- Report should be prepared in LaTeX.
- External examiner for Review 2 and Final Demo should be allocated same group.
- Report will be jointly evaluated by External examiner and Internal examiner.

REFERENCES

1. Eng-Choon Leong et al, "Guide To Research Projects For Engineering Students", CRC press, Apple Academic Press Inc. ISBN: 9781482238778, 9781482238778.
2. Michelle Reid, "Report Writing (Pocket Study Skills)", Second Edition, Macmillan Education.
3. Leslie Lamport, "A Document Preparation System LaTeX: User's Guide and Reference Manual", Pearson, 2011.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	2021 - 2022 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	COURSE NAME	Student Internship Program (Technical/ Research Skills)
	COURSE CODE	CH400
	COURSE CREDITS	4
RELEASE DATE : 01/07/2021	REVISION NO	1.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH400.CEO.1: To get acquainted with the professional organization structure
CH400.CEO.2: To enable students to apply their knowledge for development of product/system/software
CH400.CEO.3: To work individually as well as in groups
CH400.CEO.4: To get Hands-on experience in the related field
CH400.CEO.5: To formulate the engineering problem statement

COURSE OUTCOMES :

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

CH400.CO.1: Analyze a given engineering problem
CH400.CO.2: Identify an appropriate problem solving methodology
CH400.CO.3: Cultivate hands-on professional work experience prior to their graduation
CH400.CO.4: Understand the real time technical, managerial and communication skills required at the job
CH400.CO.5: Develop appropriate workplace attitudes and understand the importance of ethics in professional life

INTRODUCTION:

The main aim of Student Internship Program (SIP) is to assist all Final Year B.Tech. students to obtain internships at various centers of excellence in the industry and the academia. The ultimate goal is to imbue students with professionalism and networking capabilities using internships as a tool for providing comprehensive practical experience. Using SIP, MITAoE students will enhance their academic and professional skills, making themselves more marketable in todays competitive world. The students can harness this lucrative opportunity to apply the knowledge they acquired all through the academic career in the professional realm.

SCOPE AND STRUCTURE OF SIP:

Summer Internship Program (SIP) is offered to entrants of Final Year B.Tech. (after semester VI) that meet the eligibility criteria stated below:

Final year B.TECH entrants should apply for 4 to 6 weeks duration internships during June-July of every academic year. For this internship, REGULAR credits will be awarded. (Credit Based Internship - 4 Credits). This internship is compulsory for all the entrants of final year B.TECH. Awarded credits will be considered for the calculation of final year CGPA and will be reflected in Regular Grade Card. Student has to work for 160 hours minimum as an Intern during the said period.

MITAoE will be responsible for identifying internship oppportunities and assisting students to apply for such positions. However, any financial liability, including but not limiteed to travel, accomodation, insurance etc. incurred as direct or indirect consequence of such a position is the sole responsibility of the student and his/her guardians.

STUDENT ELIGIBILITY CRITERIA:

Students applying for internships must meet the following criteria:

After completion of sixth academic semester, Third Year B. Tech. students (Final Year B. Tech. entrants) of all schools are eligible to apply for 4 to 6 weeks duration internships under SIP. All students have to complete the internship successfully as stated in the scope of Student Internship Program. However, students who fail to earn the 4 credits for any reason, shall be required to earn the same at a later instant of time to be eligible for the award of degree as per the internship policy.

RULES FOR APPLICATION TO SIP:

Students applying to the Student Internship Program are required to adhere the following rules and need to go through SIP policy document:

1. Students must complete an undertaking to abide by the rules and regulations of the institution / industry for which they are applying for SIP.

2. Students must obtain academic and school clearances to ensure completion of prerequisite courses or other requirements as a part of their application to SIP.

3. Students must submit a well formatted CV, requisite form, financial declaration, if any, along with the undertaking stated above to the Internship Coordinator through Faculty Mentor before April 30 of every year.

4. Last date for completing all relevant formalities pertaining to SIP is 15 days prior to the start of the internship.

5. Within the first week of the internship, students are required to submit their supervisor's contact information to the Faculty Mentor and Internship Coordinator.

6. **During the internship, students must submit brief fortnightly report duly signed by their supervisor to the Faculty Mentor.**

7. **Annexure IV is the final approval for the SIP and without which no internship is approved and no queries will be entertained at a later stage.**

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Chemical Equipment Design II
	COURSE CODE	CH462
	COURSE CREDITS	4
RELEASE DATE : 01/07/2022	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	35	35	30	50	NIL	150

PRE-REQUISITE : CH362: Chemical Equipment Design I, CH363: Chemical Process Technology

COURSE OBJECTIVES :

CH462.CEO.1: Understand the concept of storage vessels and applications.
CH462.CEO.2: Get information about the heating system used in reaction vessel.
CH462.CEO.3: Get knowledge about the auxiliary process vessel and its applications.
CH462.CEO.4: Learn designing of tray column and its applications.
CH462.CEO.5: Learn the designing of packed column.
CH462.CEO.6: Learn the cost estimating & management process.

COURSE OUTCOMES :

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

CH462.CO.1: Apply the concept for designing storage vessel.
CH462.CO.2: Analyze key criteria involved for the heating system used in reaction vessel.
CH462.CO.3: Apply knowledge about the designing tray column used in chemical processes.
CH462.CO.4: Design the Piping for Equipment.
CH462.CO.5: Design of packed column.
CH462.CO.6: Demonstrate the cost estimating process.

THEORY COURSE CONTENT		
UNIT 1	**Storage Vessels**	**7 HOURS**
Study of various types of storage vessels and applications, Atmospheric vessels, vessels for storing volatile and non-volatile liquids, storage of gases, Losses in storage vessels, Various types of roofs used for storage vessels, Design of cylindrical storage vessels as per IS: 803- design of base plates, shell plates, roof plates, wind girders, curb angles for self-supporting and column supported roofs. Design of rectangular tanks as per IS: 804.		
UNIT 2	**Reaction Vessels and Agitators**	**7 HOURS**
Reaction vessels: introduction, classification, heating systems, design of vessels, study and design of various types of jackets like plain, half coil, channel, limpet oil, study and design of internal coil reaction vessels, heat transfer coefficients in coils. Agitators: Study of various types of agitators, baffling, agitator shaft diameter calculations such as twisting moment, equivalent bending moment, power requirement calculations for agitation systems .		
UNIT 3	**Design of Tray Column**	**7 HOURS**
Continuous distillation, Design variables in distillation, Design methods for binary systems, Multi-component distillation: general considerations, short-cut methods for stage and reflux requirements, rigorous solution procedures, Plate efficiency, Approximate column sizing, Plate contactors, Plate hydraulic design.		
UNIT 4	**Packed Column**	**7 HOURS**
Packed column: choices of plates or packing, packed column design procedure, packed bed height (distillation and absorption), HTU, Cornells method, column diameter, column internals, wetting rates, column auxiliaries.		
UNIT 5	**Piping Design for Equipment**	**7 HOURS**
A brief revision covering friction factor, pressure drop for flow of non-compressible and compressible fluids, (Newtonian Fluids), pipe sizing, economic velocity. Pipe line networks and their analysis for flow in branches, restriction orifice sizing. Pipe supports, NonNewtonian fluids types with examples, pressure drop calculations for Non-Newtonian fluids. Pipe line design on fluid dynamic parameter.		
UNIT 6	**Project Cost Estimation**	**7 HOURS**
Cost estimating and cost management definitions and timelines, cost estimating & management process, project complexity and impact on estimation and risk management process, risk strategy, management support for estimating and cost management practices.		

PRACTICAL		
PRACTICAL NO.01	**Design of Storage Vessels**	**2 HOURS**
Design and drawing of storage vessel used in oil industry		
PRACTICAL NO.02	**Roofs Used for Storage Vessels**	**2 HOURS**
Various types of roofs used for storage vessels		
PRACTICAL NO.03	**Sieve Plate Design for Column**	**2 HOURS**
Sieve plate design for column		
PRACTICAL NO.04	**Reaction Vessel Design: Jackets**	**2 HOURS**
Design of various types of jackets		
PRACTICAL NO.05	**Reaction Vessel Design: Agitator**	**2 HOURS**
Required power calculations for agitation systems		
PRACTICAL NO.06	**Pipe Line Network**	**2 HOURS**
Pipe line Network		
PRACTICAL NO.07	**Design of Distillation Column**	**2 HOURS**
Simulation of Shortcut / Rigorous distillation column		
PRACTICAL NO.08	**CHEMSEP Distillation Column**	**2 HOURS**
Simulation of CHEMSEP Distillation Column		
PRACTICAL NO.09	**Packed Column**	**2 HOURS**
Simulation of Absorption Column		

TEXT BOOKS

1. Joshi M.V, Mahajani V.V, Process Equipment Design, 5th Edition, MacMillan Publishers India limited. (ISBN : 9780333924181).
2. Dawande S.D, Process Design of Equipment, Central Techno Publications, Nagpur, 2000. (ISBN :8190322885).
3. Max Peters, Klaus Timmerhaus , Ronald West; Plant Design and Economics for Chemical Engineers, McGraw Hill Education; 5th edition (2017) (ISBN-13 : 978-1259002113).

REFERENCE BOOKS

1. Sinnott R.K; Chemical Engineering Series, Vol. 6, 4 th Edition, Butterworth Heinemann. (ISBN :9780080418667).
2. Richardson J.F, Harker J.H. and Backhurst J.R, Chemical Engineering, Vol. 2, 5 th Edition, Butterworth-Heinemann. (ISBN : 9780750644457).
3. James R Couper, Walas S.M, Chemical Process Equipment: Selection and Design, Gulf Professional Publishing, 1988. (ISBN : 9780409901313).
4. Brownell L.E. and Young H.E,Process Equipment Design, John Wiley, 2004. (ISBN :9780471113195).
5. 5. Pipe Drafting and Design by Roy A Parisher & Robert A. Rhea, Gulf Professional Publishing, 2012. (ISBN : 978-0123847003).

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Petrochemical Technology
	COURSE CODE	CH493
	COURSE CREDITS	3
RELEASE DATE : 01/07/2022	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	35	35	30	NIL	NIL	100

PRE-REQUISITE : CH233: Mass Transfer, Ch342: Separation Process, CH483: Petroleum Refining Technology

COURSE OBJECTIVES :

CH493.CEO.1: Apply knowledge of petroleum refining operation and process to obtain various raw materials.
CH493.CEO.2: Understand various unit operations and processes used in Petrochemical industry.
CH493.CEO.3: Identify and understand manufacturing of various petrochemicals.
CH493.CEO.4: Apply proper unit operation for desired separation.
CH493.CEO.5: Understand importance of raw material quality on product specification.
CH493.CEO.6: Understand the safety considerations in Petrochemical industry.

COURSE OUTCOMES :

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

CH493.CO.1: Understand Indian and world scenario for production and demand for Petrochemical.
CH493.CO.2: Understand specification of different raw material and its importance.
CH493.CO.3: Select proper unit operation and processes in synthesis of various Petrochemicals.
CH493.CO.4: Interpret the petrochemical Flowsheet and its major engineering problems.
CH493.CO.5: Select proper process from available process.
CH493.CO.6: Understand uses of petrochemicals product.

THEORY COURSE CONTENT		
UNIT 1	**Introduction of Petrochemical Industry**	**7 HOURS**
Introduction to petrochemical, petrochemical industry in India, Indian and world scenario of petrochemical industry, basic raw material for petrochemical synthesis and their sources, preparation of feedstock for petrochemical production, main building blocks of petrochemical industry.		
UNIT 2	**C1, C2 and its derivatives**	**7 HOURS**
Methane : Synthesis Gas, FTS, Methanol, Acetic acid, Formaldehyde Production. Ethane: Ethylene, Ethylene oxide, Ethanol, Glycol Production.		
UNIT 3	**Processing of C3, C4 and C5 stream**	**7 HOURS**
Sources of Propylene, Propylene oxide, IPA, acetone. Processing of C4 stream from Steam Cracker and FCC, Oxygenates from Refinery. C4 and C5 stream: methyl tertiary Butyl ether, tertiary Amyl methyl ether.		
UNIT 4	**Aromatic Production**	**7 HOURS**
Aromatic production and aromatic conversion processes for BTX, advances in reformer Introduction to catalyst, future trend in aromatic production, separation processes in aromatic production, linear alkyl benzene technology and separation processes and design criteria.		
UNIT 5	**Olefin Production**	**7 HOURS**
Olefin production by Steam cracking process technology, Emerging technology for production of olefins.		
UNIT 6	**Aromatic and Olefin derivatives**	**7 HOURS**
Process technology for phenol, benzoic acid from toluene, glycols, amines, acids, ketones.		

TEXT BOOKS

1. I. D. Mall, Petrochemical Process Technology, Macmillan India Ltd., New Delhi, ISBN: 9781403931979.
2. Bhaskara Rao. B.K., Petrochemicals, 3rd Edition, Khanna Publishers 2000.
3. Gary J H, Handwerk G E, Petroleum refining technology and economics, Marcel Dekker Inc. ISBN: 0824704827.
4. Lueas A. G., Modern Petroleum Technology Part II, by Institute of Petroleum (IP), John Wiley ISBN: 9780470850220.

REFERENCE BOOKS

1. Kirk & Othmer, Concise Encyclopedia of Chemical Technology, 5th Edition, Wiley Publishers, 2007, ISBN: 9780470047484.
2. Faith W.L, Lowenheim F.A, Moran M.K, Industrial Chemicals, 4th Edition, Wiley Publishers, ISBN: 9780471549642.
3. Groggins P.H, Unit process in organic synthesis, 5th Edition, McGraw Hill, 2004, ISBN: 9780074621431.
4. Speight J G, The Chemistry and technology of petroleum, CRC Press. ISBN: 9781439873892.
5. Myers, Handbook of Petroleum Processing, McGraw-Hill Education. ISBN: 9780071391092.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	COURSE NAME	Bioprocess Technology
	COURSE CODE	CH494
	COURSE CREDITS	3
RELEASE DATE : 01/07/2022	REVISION NO	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	35	35	30	NIL	NIL	100

PRE-REQUISITE : CH484: Biochemical Engineering

COURSE OBJECTIVES :

CH494.CEO.1: Develop bioprocess product manufacturing Skills.
CH494.CEO.2: Understand engineering principles to address issues in bioprocessing.
CH494.CEO.3: Estimate kinetics parameters from raw fermentation data.
CH494.CEO.4: Identify limiting factors in downstream processing.

COURSE OUTCOMES :

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

CH494.CO.1: Identify role of bioprocess engineering.
CH494.CO.2: Select Appropriate Bioreactor Configurations and Operation.
CH494.CO.3: Interpret preliminary design for a bioreactor.
CH494.CO.4: Compare which unit operations are required before and after a bioreactor.
CH494.CO.5: Develop block flow diagram and process flow diagram for bioprocesses.
CH494.CO.6: Analyze kinetics of cell growth.

THEORY COURSE CONTENT		
UNIT 1	**Basic Principle of Bioprocesses**	**7 HOURS**
Isolation, screening and maintenance of industrially important microbes; Microbial growth and death kinetics (an example from each group, particularly with reference to industrially useful microorganisms); Strain improvement for increased yield and other desirable characteristics.		
UNIT 2	**Types of Fermentation Processes**	**7 HOURS**
Bioreactor designs; Types of fermentation and fermenters; Concepts of basic modes of fermentation - Batch, fed batch and continuous; Conventional fermentation v/s biotransformation; Solid substrate, surface and submerged fermentation; Fermentation economics; Fermentation media; Fermenter design-mechanically agitated; Pneumatic and hydrodynamic fermenters; Large scale animal and plant cell cultivation and air sterilization; Upstream processing: Media formulation; Sterilization; Aeration and agitation in bioprocess; Measurement and control of bioprocess parameters; Scale up and scale down process.		
UNIT 3	**Downstream Processing**	**7 HOURS**
Bio-Separation - filtration, centrifugation, sedimentation, flocculation; Cell disruption; Liquid-liquid extraction; Purification by chromatographic techniques; Reverse osmosis and ultra filtration; Drying; Crystallization; Storage and packaging; Treatment of effluent and its disposal.Chromatographic separation Techniques.		
UNIT 4	**Design of Immobilized Enzyme Systems**	**7 HOURS**
The design and construction of novel enzymes, Design and configuration of immobilized enzyme reactors, applications of immobilized enzyme technology.		
UNIT 5	**Food Bioprocess Technology**	**7 HOURS**
Fermented foods and beverages; Food ingredients and additives prepared by fermentation and their purification; fermentation as a method of preparing and preserving foods; Microbes and their use in pickling, producing colors and flavors, alcoholic beverages and other products; Process wastes-whey, molasses, starch substrates and other food wastes for bioconversion to useful products; Bacteriocins from lactic acid bacteria Production and applications in food preservation.		
UNIT 6	**Industrial Production of Bio-Chemicals**	**7 HOURS**
Industrial process using enzymes for production of drugs, Alcohols, acids (citric, acetic and gluconic), solvents (glycerols, acetone, butanol), antibiotics (penicillin, streptomycine, tetracycline) amino acids (lysine, glutamic acid), single cell proteins.		

TEXT BOOKS

1. Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998, ISBN: 9781555811365.
2. Voet D, Voet JG & Pratt CW, Fundamentals of Biochemistry, 2nd Edition. Wiley 2006.

REFERENCE BOOKS

1. J. E. Bailey & D. F. Ollis, Biochemical Engineering Fundamentals , McGraw Hill Book Company, 1986, ISBN: 9780070701236.
2. Michael L. Shuler & Fikret Kargi, Bioprocess Engineering Basic Concepts, 2 nd edition, Prentice Hall of India, New Delhi, 2002, ISBN: 9788120321106.
3. Wiseman A (Ed.), Topics in enzyme and fermentation Bio-technology, Ellis mand Harwood, U.K. Vol-5, ISBN: 9885177332121.
4. Campbell AM & Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings 2007, ISBN: 9780805382198.
5. Brown TA, Genomes, 3rd Edition. Garland Science 2006, ISBN: 9780815345244.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Chemical Process Safety
	COURSE CODE	CH495
	COURSE CREDITS	3
RELEASE DATE : 01/07/2022	**REVISION NO**	1.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	35	35	30	NIL	NIL	100

PRE-REQUISITE : CH363: Chemical Process Technology

COURSE OBJECTIVES :

CH495.CEO.1: Know various process utilities.
CH495.CEO.2: Understand about safety aspects in industry.
CH495.CEO.3: Understand the importance of loss of prevention.
CH495.CEO.4: Understand about hazard analysis and toxicology.
CH495.CEO.5: Learn about storage and handling of hazardous chemicals.
CH495.CEO.6: Learn about risk and hazard analysis.

COURSE OUTCOMES :

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

CH495.CO.1: Apply the basic principles of safety.
CH495.CO.2: Develop the roots for hazard analysis.
CH495.CO.3: Identify the event tree and fault tree analysis.
CH495.CO.4: Analyze the hazards in a given process and assess them to provide solutions for operating safely.
CH495.CO.5: Knowledge to choose the safety requirements for storage and handling of a given chemical.
CH495.CO.6: Formulate the important of risk factors and factors.

THEORY COURSE CONTENT		
UNIT 1	**Industry Accident, Safety & Personal Protective Equipments**	**7 HOURS**
Industry Accident: Major Chemical Industry Accidents: Flixborough Disaster, Seveso Disaster, The Mexico LPG Disaster, Bhopal Disaster, Phillips Disaster. Disaster management and emergency planning. Safety & Personal Protective Equipments: Risk, Hazard, Chemical Hazard Symbols, Incompatible chemicals, Fire Classification; Occupational Health and Safety Administration, The Factories Act, Personal Protective Equipment (PPE).		
UNIT 2	**Toxic Substance, Fire and Explosion**	**7 HOURS**
Toxic Substance and Confined Spaces: Toxic Substances Definition, Classes of Toxicity, Entry Points for Toxic Agents, Effects of Toxic Substance, Relationship of Doses and Responses, Threshold Limiting Values, Exposure Thresholds, Airborne Contaminants, Confined Spaces Hazards, Respiratory Protection, Prevention and Control. Fire and Explosion: Work Place Hazard, Dangerous Substance Fire triangle, Effective Ignition Source, Static Electricity, Explosion: BLEVE, VCE, Detonation and Deflagration, Flammability Limits, LOC, Flash point, Flammability Diagram, Flammable and Combustible Liquids.		
UNIT 3	**Chemical Process Safety**	**7 HOURS**
Chemical Process Safety: Decomposition & Runaway Reactions, Initiating factors Reactive Chemical Hazard, Case Studies: T2 Laboratories, Florida, Synthron, North Carolina, Phenol-Formaldehyde Reaction. Assessing Reaction Hazard; Tools for evaluating thermal explosion, Steps to Reduce Reactive Hazards. Process Plant Design: Flow Diagrams; Piping and Instrumentation Diagram, Control System, Alarms, Chemical Plant Layout: Passive protection, Active Protection, Emergency Shutdown System, Safety Integrity Level, Inherent Safety Techniques.		
UNIT 4	**Industrial Hygiene**	**7 HOURS**
Government regulations, laws, MSDS, identification, evaluation: evaluating exposures to volatile toxicants by monitoring, evaluating worker exposures to dusts, evaluating worker exposures to noise, estimating worker exposures to toxic vapors. LOPA, SIL.		
UNIT 5	**Hazard Identification, Risk Assessment and HAZOP**	**7 HOURS**
Hazard Identification & Risk Assessment: The Process of Risk Management, Hazard Identification, Evaluation (Risk Assessment, Risk Matrix), Risk Control Implementation, Action and Recommendation. Hazard and Operability Studies (HAZOP): HAZOP technical approach, Procedure, Analysis Terminology, Guidewords, Parameters. Examples, Advantages, Weakness.		
UNIT 6	**Safety and Production**	**7 HOURS**
Safety versus production, Hazard models and risk data, Fault tree analysis, Tackling disasters, plan for emergency. Risk management routines, Emergency shutdown systems, Role of computers in safety, Prevention of hazard human element, Technology and process selection.		

TEXT BOOKS

1. Daniel A. Crowl and Joseph F. Louvar, Chemical Process Safety: Fundamentals with applications, Prentice Hall, Inc, 1990, (ISBN: 9780131382268).
2. P. P. Leos, Loss prevention in process Industries, Vol 1 and 2 Butterworth, 1983, (ISBN: 0750615478).

REFERENCE BOOKS

1. R. W. King and J. Magid, Industrial Hazards and Safety Handbook, Butterworth, 1982, (ISBN: 9780408003049).
2. Khulman, Introduction of Safety Science, TUV Rheinland, 1986, (ISBN 9781461385967).
3. W. E. Baker, Explosion, hazards and Evaluation, Elsevier, Amsterdam, 1983, (ISBN: 9780444420947, 9780444599889).
4. O. P. Kharbanda and E. A. Stallworthy, Management of Disasters and How to Prevent Them. Grower, 1986, (ISBN: 9780876839461).

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Engineering Economics
	COURSE CODE	HP405
	COURSE CREDITS	2
RELEASE DATE : 01/07/2022	**REVISION NO**	1.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

HP405.CEO.1: To study the basic concepts of economics
HP405.CEO.2: To use the practical applications of economic feasibility
HP405.CEO.3: To understand the concept of banking and features
HP405.CEO.4: To illustrate the financial planning and saving options

COURSE OUTCOMES :

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

HP405.CO.1: Relate the basic concepts of engineering economics
HP405.CO.2: Apply the economic viability of firm/organization under different market conditions
HP405.CO.3: Explain the bank structures and its schemes
HP405.CO.4: Execute the effective way of financial budget and skills

THEORY		
UNIT 1	**Introduction to Economics**	**6 HOURS**
Economic issues and concepts; How economist work, Theory of demand and supply; meaning, Determinants, Equilibrium between demand and supply; Elasticity of demand; Price elasticity; Income elasticity; Cross elasticity, Characteristics of an Indian economy, Concepts of foreign trade, Goods and Services Tax (GST), Globalization, Liberalization, Privatization, Global market indices, Foreign Direct Investment (FDI). **Case studies:** Housing market, General raw products/fuel market, Electronic devices, Startups, etc. **Further readings:** Introduction to Crypto-currency, Impact and analysis in the foreign market.		
UNIT 2	**Micro Economics and Macro Economy**	**6 HOURS**
Revenue concepts, Cost concepts, Short run and long run cost concepts and curves, Opportunity cost. Markets; meaning, types of markets and their characteristics, National Income (NI); meaning, stock and ow concept, NI at current price, NI at constant price, Gross National Product (GNP), Gross Domestic Product (GDP), Net National Product (NNP), Net Domestic Product (NDP), Personal income, Disposal income, Inflation: meaning, types, causes, measures to control. **Case studies:** Economics network, Economic influences of COVID-19 pandemic, etc.		
UNIT 3	**Capital Cost Estimation and Economic Viability Study**	**5 HOURS**
Typical capital cost component, Cost Index (CI), Typical operating cost components, Classes of cost estimates, Cost estimation by applying factors, Detailed cost estimation method, Financial viability calculation (Payback period, Break-even point, Internal rate of return (IRR) and Net present value (NPV); numerical), Cash flow diagrams, Profitability criteria Project evaluation and index. **Case studies:** Detailed spreadsheet of product cost, Determination of project cost, Net profit/loss, etc.		
UNIT 4	**Introduction to Banking & Money Market**	**5 HOURS**
Banking; meaning, types, functions, Commercial banks- Instruments in operation of an account, Central bank- Reserve Bank of India (RBI); its functions, Concepts and influences- Cash Reserve Ratio (CRR), Bank rate, Repo rate, Reverse repo rate, Statutory Liquidity Ratio (SLR), Introduction to money and capital market, Introduction to fiscal policy- meaning and tools. **Further readings:** Retail banking, Demonetization, Banking management, etc.		
UNIT 5	**Financial Literacy and Planning**	**6 HOURS**
Importance of financial planning, literacy and budgeting, Savings related products, Insurance related products, Pension, Retirement and estate planning, Borrowing related products, Basic and advanced investing, Government schemes for various savings and investment options, Tax savings options. **Case studies:** Shore Financial, Real life examples, Goal-Planning, etc. **Self studies:** Protect your family financial and retirement planning.		

REFERENCE BOOKS

1. N G. Mankiw: Economics: Principles of Economics, Cengage Learning (2003), ISBN: 1305585127.
2. J. Bradfield, Introduction to the Economics of Financial Markets, Oxford University Press, New York (2007), ISBN: 9780195310634.
3. F. Vega-Redondo, Economics and the theory of games, Cambridge University Press (2003), ISBN: 9780521775908.
4. C. S. Park, Fundamentals of Engineering Economics, Prentice Hall (2003), ISBN: 9780130307910.
5. D. E. O'Connor, The Basics of Economics, Greenwood Publisher (2004), ISBN: 9780313325205.
6. V. V. Mahajani, S. M. Mokashi, Chemical Project Economics, Macmillan India Ltd. (2005), ISBN: 1403928142.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Psychology
	COURSE CODE	HP406
	COURSE CREDITS	2
RELEASE DATE : 01/07/2022	**REVISION NO**	1.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

HP406.CEO.1: To introduce the basic concept of Psychology.

HP406.CEO.2: To explain how learning and conditioning occurs in everyday life through both nature and nurture factors.

HP406.CEO.3: To know the main schools of thought and prime contributors to the theory of workplace motivation.

HP406.CEO.4: To develop insight into ones own and others behavior and underlying mental processes.

HP406.CEO.5: To develop Positive Psychology interventions to increase personal well-being.

COURSE OUTCOMES :

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

HP406.CO.1: Explain the basic concepts of Psychology.

HP406.CO.2: Apply the concept of conditioning in day to day life.

HP406.CO.3: Explain the main schools of thought and prime contributors to the theory of workplace motivation.

HP406.CO.4: Demonstrate effetely the personality traits in regular life.

HP406.CO.5: Employ Positive Psychology interventions to increase personal well-being.

THEORY

UNIT 1	Basics of Psychology	6 HOURS

Meaning, Nature, Objective of Psychology, Learning: meaning, classical conditioning, operant conditioning; Attention and Perception: definition, types of attention, determinants of attention.

UNIT 2	Social Interactions	6 HOURS

Conformity, Compliance, Obedience, Stereotypes, Attitudes: nature, characteristics, attitude formation and attitude change; Prejudice and Discrimination- characteristics and types of prejudice, development and maintenance of prejudice and discrimination, manifestation of prejudice, methods of reducing prejudice and discrimination.

UNIT 3	Need and Motivation	6 HOURS

Meaning; extrinsic and intrinsic motivation, Vrooms Expectancy Theory of Motivation, Herzberg's Motivators and Hygiene Factors, Maslow's Hierarchy of Needs.

UNIT 4	Self and Identity	6 HOURS

Meaning and Need, Erik Eriksons Stages of Psychosocial Development, Carl Rogers' Theory of Personality, Thomas Harriss Transactional Analysis, Johari Window, SWOT .

UNIT 5	Positive Psychology	4 HOURS

Introduction to Positive Psychology; From Learned Helplessness to Learned Optimism, Building the Skill of Gratitude, VIA Classification of Character Strengths and Virtues, Identifying and Using Your Signature Strengths, Resilience and Optimism, Cognitive Strategies to Increase Optimism and Resilient Thinking, Managing Anxiety and Increasing Positive Emotions .

TEXT BOOK

1. S. Cicearelli, J. Noland White, Psychology 4th Edition, Pearson Publisher, ISBN-13:9780208972241.
2. Robert A. Baron, Introduction to Psychology 3rd Edition, Pearson Education Company, ISBN-10:0536813906.
3. Stephen P. Robbins, Timothy. A. Judge, Organizational Behavior 15th Edition, Pearson Education Inc., ISBN-10:0-13-283487-1.
4. Robert. A. Baron, Nyla. R. Branscombe, Social Psychology 13th Edition, Pearson Education India, ISBN-13:978-9332569911.

REFERENCE BOOK

1. Kathleen M. Galotti, Cognitive Psychology 2nd Edition, SAGE Publications India Pvt. Ltd. ISBN:978-93-515-0277-7.
2. Robert S. Feldman, Understanding Psychology 10th Edition, McGraw Hill Education (India) ISBN:10: 1-25-900305-1.
3. Elliot Aronson, Timothy D. Wilson, Robin M. Akert, Social Psychology 8th Edition, Pearson Education, ISBN:9788131730898.
4. Calvin S. Hall, Gardner Lindzey, John B. Campbell, Theories of Personality 4th Edition Choudhary Press, Delhi, ISBN: 978-81-265-1092-4.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Capstone Work
	COURSE CODE	CH480
	COURSE CREDITS	4
RELEASE DATE : 01/07/2022	**REVISION NO**	0.0

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

PREREQUISITE : NIL

COURSE OBJECTIVES :

CH480.CEO.1: Improve individual perspectives to find solutions at different scales

CH480.CEO.2: Identify the capstone work, formulate the methodology along with a significant collection of artifacts and outcomes.

CH480.CEO.3: Synthesize a reflective report to effectively communicate and explore findings.

CH480.CEO.4: Create a professional portfolio that technically, graphically and verbally describes pertinent achievements and the progressive growth during the program.

COURSE OUTCOMES :

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

CH480.CO.1: Portray individual skill for solving the problem. (L4)

CH480.CO.2: Showcase the best techniques and suitable methodology. (L5)

CH480.CO.3: Cognize the significance of report and comprehend its reflections. (L4)

CH480.CO.4: Assimilate digital and visual literacies. (L5)

COURSE ABSTRACT

Capstone work is an individual, self-identified project that focuses on technical/non-technical issues. Capstone work requires taking risks, high productivity, strong design research, quick turnaround times, creating an advanced design. A Digital portfolio is an integrative collection of work that draws together skills gained from across the taught phase of the program. It comprises a structured set of papers that enabled application and critical reflection. It is an amalgamation of both written and visual content that draws out the evolution of thinking around the ways in which design, social constructs, and emerging technologies intercept. It exposed process, critical thinking, as well as final artifacts, concepts, and its contents articulated in depth. The student enables to learn powerful new methods to promote his online self-design profile. It will help to established a professional voice by writing a personal design philosophy and a reflective article for the Linked In profile page. The opportunity to choose the project,formulate solution, negotiate deliverable, work individually, and present digitally is what makes the Capstone portfolio unique.

Capstone portfolio is divided into two section

a) Capstone work

b) Digital Portfolio

CAPSTONE WORK

Individual student can choose the topic from one of the below capstones to carry out the work during the entire semester

1. Technical Capstone
    - Industry identified problem
    - Institute identified problem
    - Urban city identified problems
    - Rural Development
    - Environmental related problems
    - Student Conceived problems
    - Satisfactory solution to Open ended problems
    - Innovative Design stemming from Student/Faculty
    - Product Development
    - App/ Software Development
    - Multidisciplinary approach to existing problem
    - Modeling/Optimization/Analysis study

2. Writing Intensive Capstone
    - Design
    - Literature Survey
    - Commercial Survey
    - Social media Survey
    - Idea/ Design Philosophy
    - Research Methodology
    - Consultancy Project work
    - Collaborative Project work
    - Laboratory/Digital classroom
    - Manage/lead any Event/activity
3. General Capstone
    - State of art
    - Creating YouTube channel
    - Design Blog/Forum
    - Challenges and Prospect of Technology (Engineering) Education in Primary and Secondary Schools
    - Market Statistics

DIGITAL PORTFOLIO

Individual student should create there own digital portfolio by using the standard professional platforms/blogs based on the record during their entire Under Graduate program. Digital portfolio should be professional, amalgamation of technical, written, graphical/Visual content and Verbal culmination of the skills and knowledge that students have developed over their under graduate program.

1. Process Portfolio
2. Show case Portfolio
3. Hybrid Portfolio

GUIDELINES

1. Individual student will work for Capstone work for entire semester.
2. Individual student will create their own digital portfolio.
3. Individual student should choose the title of the capstone work with approval from the Supervisor and School Dean
4. Student should work on the topic approved with all necessary information, evidences and the measurable outcomes.
5. Student will have to write the graduation book on the capstone work.
6. Students have to follow the guidelines of plagiarism for graduation book.
7. If Student perceive exemplary achievement it can can consider as capstone work review 2. This will ensure the competency of students which they have learn during their undergraduate program. However supervisor can take stand if the capstone work is remarkable, he/she may ask to write a small report for the record.However supervisor can take stand if the capstone work is good, he/she may ask to write one small report.
    - Published Article in Scopus Index Journal
    - Approved Research Proposal
    - Winner for Design Competitions/Tech fest/ Workshop
    - Winner for State/National/International Event (Technical/Non-technical)
    - Valid score in Competitive exams (GATE/CAT/GRE-TOEFL/IELTS)
8. Capstone work and Digital portfolio need to be reviewed by supervisor and one faculty of same department to ensure whether student have followed all the guideline and work is appropriate and worth for evaluation.
9. Final examination will be conducted in the presence of Jury.

ASSESSMENT and EVALUATION

The Jury will be appointed to monitor the progress and continuous evaluation of each project. One of the member will be the Capstone work supervisor. Assessment shall be done jointly by the supervisor and jury members.

1. Capstone work Review 1 (25 Marks)
2. Capstone work Review 2 (25 Marks)
3. Creating Digital Portfolio (50 Marks)
4. Graduation book (25 Marks)
5. Final Demonstration (25 Marks)

REFERENCES

1. https://design.berkeley.edu/
   Berkeley M.Des. University of California, U.S.
2. https://design.gatech.edu/
   Georgia Institute of Technology, College of Design Atlanta, U.S.
3. https://www.apus.edu/
   American Public University
4. https://msu.edu/
   Michigan State Universitys US
5. https://www.cranfield.ac.uk
   Cranfield University, Shrivenham Swindon UK
6. https://my.bulbapp.com/personalized-learning/assessment-infographic-blog/
7. https://edtechjeffco.weebly.com
8. https://www.invisionapp.com/inside-design/10-portfolio-websites-to-show-off-your-design-work/

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Curriculum

For

Final Year

Bachelor of Technology in

Chemical Engineering

(Amendments for Semester Long Internship)

2019-2023

(With Effect from Academic Year: 2022-2023)

SEMESTER: VIII (PART B SEMESTER LONG INTERNSHIP)												
COURSE			TEACHING SCHEME			EXAMINATION SCHEME AND MARKS						CREDIT
TYPE	CODE	NAME	Hour/Week			THEORY			PRACT		TOTAL	
			L	P	T	MSE	ESE	IA	T/P	DM		
DC15	CH462	Chemical Equipment Design II	3	2	-	35	35	30	50	0	150	4
DE02	CH49#	Refer Annexure	3	0	-	35	35	30	0	0	100	3
SDP16	CH467	Semester Long Internship Design	-	-	-	-	-	-	-	150	150	4
SDP17	CH468	Semester Long Internship Implementation	-	-	-	-	-	-	-	150	150	4
TOTAL			**6**	**2**	**0**	**70**	**70**	**60**	**50**	**300**	**550**	**15**

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	COURSE NAME	Semester Long Internship Program (SLIP)-Design
	COURSE CODE	CH467
	COURSE CREDITS	4
RELEASE DATE : 01/07/2022	REVISION NO	1.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH467.CEO.1: To get acquainted with the organization structure
CH467.CEO.2: To gain learning and living experience
CH467.CEO.3: To develop appropriate workplace attitudes
CH467.CEO.4: To get Hands-on experience in the related field to relate and reinforce what has been taught at the university
CH467.CEO.5: To formulate the problem statement

COURSE OUTCOMES :

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

CH467.CO.1: Analyze a given engineering problem
CH467.CO.2: Identify an appropriate problem solving methodology
CH467.CO.3: Prepare themselves to work in cross-cultural, multi-national environment
CH467.CO.4: Improve self-confidence and independency
CH467.CO.5: Develop ability to work individually as well as in groups

ELIGIBILITY:

I. No live backlogs

II. 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.

APPLICATION PROCEDURE:

The student must submit a proposal of the semester-long internship including the 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 corporatee relations (CR) coordinator. The application must be prescibed in the SLIP policy.

TIMELINE:

The Semester Long Internship Program (SLIP) is carried out in two phases viz. SLIP - Design and SLIP - Implementation. SLIP - Design is a mandatory phase.

ASSESSMENT METHOD FOR SEMESTER LONG INTERNSHIP:

I. Credits for the semester-long internship need to be earned by the students by the following assessment in front of the panel. The Panel for the evaluation should be 3 members or 4 members. 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

II. Presentation I in the mid of the internship and Presentation II at the end of the internship combined to a total weightage of 4 credits. **In grade card it will be mentioned as SLIP - Design.**

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABUS	
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	2022 - 2023 (Rev. 2019)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	COURSE NAME	Semester Long Internship Program (SLIP)-Implementation
	COURSE CODE	CH468
	COURSE CREDITS	4
RELEASE DATE : 01/07/2022	REVISION NO	1.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH468.CEO.1: To get acquainted with the organization structure
CH468.CEO.2: To gain learning and living experience
CH468.CEO.3: To develop appropriate workplace attitudes
CH468.CEO.4: To get Hands-on experience in the related field to relate and reinforce what has been taught at the university
CH468.CEO.5: To formulate the problem statement

COURSE OUTCOMES :

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

CH468.CO.1: Analyze a given engineering problem
CH468.CO.2: Identify an appropriate problem solving methodology
CH468.CO.3: Prepare themselves to work in cross-cultural, multi-national environment
CH468.CO.4: Improve self-confidence and independency
CH468.CO.5: Develop ability to work individually as well as in groups

ELIGIBILITY:

I. No live backlogs

II. Semester Long Internship Program (SLIP) - Design must be completed.

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.

ASSESSMENT METHOD FOR SEMESTER LONG INTERNSHIP:

I. Credits for the semester-long internship need to be earned by the students by the following assessment in front of the panel. The Panel for the evaluation should be 3 members or 4 members. 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

II 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 4 credits and should be as per the template.

In grade card it will be mentioned as SLIP - Project Implementation.