MIT | Academy of Engineering

MIT ACADEMY OF ENGINEERING, ALANDI

An Autonomous Institute Affiliated to

Savitribai Phule Pune Univeristy

Curriculum

For

Bachelor of Technology

In

Chemical Engineering

(Choice Based Credit System)

2016-2020

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

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

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

MIT Academy of Engineering

An Autonomous Institute Affiliated to Savitribai Phule Pune University

CURRICULUM FRAMEWORK

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

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

The Course and Credit Distribution shall be as under,

SL. NO.	TYPE OF COURSE	NO. OF COURSES	TOTAL CREDITS	
			NO.	%
1.	Natural Science	**4**	**18**	**10.98**
2.	Engineering Science	**4**	**16**	**9.76**
3.	Program Core	**5**	**19**	**11.58**
4.	Discipline Core	**12**	**48**	**29.26**
5.	Department Elective	**2**	**6**	**3.66**
6.	Open Elective	**4**	**16**	**9.76**
7.	Humanities and Social Science	**8/9**	**17**	**10.36**
8.	Skill Development and Project	**10/9**	**24**	**14.64**
TOTAL		**49**	**164**	**100**

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

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE STRUCTURE (2016 - 2020)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2016-17
FIRST YEAR BACHELOR OF TECHNOLOGY	RELEASE DATE	:	1/06/2016
	REVISION NO.	:	0.0

SEMESTER: I

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

SEMESTER: II

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	NSC3	AS104	Mathematics – 2	4	1	5
2.	NSC4	AS103 / AS102	Chemistry / Physics	3	2	4
3.	ESC3	CV101 / EX101	Applied Mechanics / Electrical& Electronics Engg.	3	2	4
4.	ESC4	IT101 / ME101 /	Computer Programming / Engineering Graphics	2	4	4
5.	HSS2	HP102	Language & Communication – 2	1	2	2
6.	SDP2	ME103 / ME102	Design Thinking / Experimental Tools & Techniques	---	4	2
TOTAL				**13**	**15**	**21**

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE STRUCTURE (2016 - 2020)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2017-18
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEEERING	RELEASE DATE	:	1/06/2017
	REVISION NO.	:	0.0

SEMESTER: III

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	PC1	CH201	Environmental Science	2	2	3
2.	PC2	AS201	Applied Mathematics	3	2	4
3.	PC3	ET201	System Engineering	3	2	4
4.	DC1	CH202	Material and Energy Balance	3	2	4
5.	DC2	CH203	Chemical Engineering Operations	3	2	4
6.	SDP3	ET206	Prototyping	---	4	2
TOTAL				**14**	**14**	**21**

SEMESTER: IV

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	HSS3	HP201	Psychology	3	---	3
2.	PC4	IT201	Engineering Informatics	3	2	4
3.	PC5	ME201	Material Engineering	3	2	4
4.	DC3	CH211	Momentum Transfer	3	2	4
5.	DC4	CH212	Advanced Chemistry	3	2	4
6.	SDP4	CH213	Minor Project	---	4	2
TOTAL				**15**	**12**	**21**

L: Lecture, P: Practical

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	CURRICULUM STRUCTURE (2016 - 2020)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2018-19
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEEERING	RELEASE DATE	:	1/12/2017
	REVISION NO.	:	0.0

SEMESTER: V

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC5	CH301	Chemical Engineering Thermodynamics	3	2	4
2.	DC6	CH302	Heat Transfer	3	2	4
3.	DC7	CH303	Mass Transfer	3	2	4
4.	OE1	CH31#	Open Elective - Refer Annexure.	3	2	4
5.	HSS4	HP302	Professional Skills	0	4	2
6.	SDP5	CH304	Skill Development Lab	---	4	2
TOTAL				**12**	**16**	**20**

SEMESTER:VI

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC8	CH 321	Separation Process	3	2	4
2.	DC9	CH 322	Chemical Reaction Engineering	3	2	4
3.	DC10	CH 323	Chemical Equipment Design	2	4	4
4.	OE2	CH 33#	Open Elective - Refer Annexure.	3	2	4
5.	HSS5	HP301	Project Management	1	2	2
6.	HSS6	HP303	Basics of Entrepreneurship	---	2	1
7.	SDP6	CH324	Mini Project	---	4	2
TOTAL				**12**	**18**	**21**

L: Lecture, P: Practical

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	CURRICULUM STRUCTURE (2016 - 2020)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2019-20 (PART A)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEEERING	RELEASE DATE	:	1/12/2018
	REVISION NO.	:	0.0

SEMESTER: VII

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC11	CH401	Process Dynamics, Control & Instrumentation	3	2	4
2.	DE1	CH41#	Dept. Elective - Refer Annexure.	3	0	3
3.	OE3	CH42#	Open Elective - Refer Annexure.	3	2	4
4.	HSS7	HP402	Sociology	2	---	2
5.	HSS8/ SDP7	HP403/ CH402	Business Strategies / Skill Development Lab 2	---	2	1
6.	SDP8	CH403	Project - I	---	8	4
7.	SDP9	CH404	Summer Internship	---	---	4
TOTAL				**11**	**14**	**22**

SEMESTER: VIII

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC12	CH431	Chemical Process Technology	3	2	4
2.	DE2	CH44#	Dept. Elective - Refer Annexure.	3	0	3
3.	OE4	CH45#	Open Elective - Refer Annexure.	3	2	4
4.	HSS9	HP401	Engineering Economics	2	---	2
5.	SDP10	CH432	Project - II	---	8	4
TOTAL				**11**	**12**	**17**

L: Lecture, P: Practical

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	21	**42**
2.	Second Year	21	21	**42**
3.	Third Year	20	21	**41**
4.	Final Year	22	17	**39**
TOTAL				**164**

CONTACT HOURS				
SL. NO.	**YEAR**	**SEMESTER**		**TOTAL**
		1	**2**	
1.	First Year	28	28	**56**
2.	Second Year	28	27	**55**
3.	Third Year	28	30	**58**
4.	Final Year	25	23	**48**
TOTAL				**217**

ANNEXURE

Natural Science (NSC) : 4 Courses		
Sl. No.	**Course Code**	**Course**
1.	AS101	Mathematics – 1
2.	AS102	Mathematics – 2
3.	AS103	Physics
4.	AS104	Chemistry

Engineering Science (ESC) : 4 Courses		
Sl. No.	**Course Code**	**Course**
1	EX101	Electrical and Electronic Engineering
2	CV101	Applied Mechanics
3	ME101	Engineering Graphics
4	IT101	Computer Programming

Program Core (PC) :5 Courses		
Sl. No.	**Course Code**	**Course**
1.	CH201	Environmental Science
2.	AS201	Applied Mathematics
3.	ET201	System Engineering
4.	IT201	Engineering Informatics
5.	ME201	Material Engineering

Discipline Core (DC) : 12 Courses		
Sl. No.	**Course Code**	**Course**
1.	CH202	Material and Energy Balance
2.	CH203	Chemical Engineering Operations
3	CH211	Momentum Transfer
4	CH212	Advanced Chemistry
5	CH301	Chemical Engineering Thermodynamics
6	CH302	Heat Transfer
7	CH303	Mass Transfer
8	CH321	Separation Process
9	CH322	Chemical Reaction Engineering
10	CH323	Chemical Equipment Design
11	CH401	Process Dynamics, Control & Instrumentation
12	CH431	Chemical Process Technology

Department Elective (DE) : 2 Courses		
Sl. No.	**Course Code**	**Course**
1	CH411	Introduction to Paint Technology
2	CH441	Paint Manufacturing Process
3	CH412	Energy Engineering
4	CH442	Energy Management and Audit
5	CH413	Petroleum Refining Technology
6	CH443	Petrochemical Engineering
7	CH414	Biochemical Engineering
8	CH444	Bioprocess Technology
9	CH415	Environment Engineering
10	CH445	Chemical Process Safety

Open Elective (OE) : 4 Courses		
Sl. No.	**Course Code**	**Course**
1	CH311	Process Modeling and Simulation.
2	CH331	Process Engineering.
3	CH421	Process Synthesis, Design and Optimization
4	CH451	Process Intensification and Integration
5	CH312	Piping Engineering
6	CH332	Piping Layout
7	CH422	Piping Design and Engineering
8	CH452	Pipeline Engineering

Open Elective (OE) :Term - I (List of courses for Academic Year 2018-19)		
Chemical		
1	CH311	Process Modeling and Simulation.
2	CH312	Piping Engineering
Civil		
3	CV311	Construction Planning & Management
Computer		
4	CS311	Descriptive Analytics
5	CS312	Artificial Intelligence & Neural Network
Electronics		
6	EX311	Fundamentals of Robotics
E & TC		
7	ET311	Embedded System Programming (ESP)
8	ET312	IoT Architecture and Sensors
IT		
9	IT311	Cryptography & System Security
Mechanical		
10	ME311	Geometric Modeling & Design
11	ME312	Fundamentals of Robotics
12	ME313	Work Process Assessment

Open Elective (OE) :Term - II (List of courses for Academic Year 2018-19)		
Chemical		
1	CH331	Process Engineering.
2	CH332	Piping Layout
Civil		
3	CV331	Visualization & Information Exchange
Computer		
4	CS331	Data Science-I
5	CS332	Machine Learning
Electronics		
6	EX331	Kinematics and Dynamics of Robotics
E & TC		
7	ET331	Embedded Processor
8	ET332	IoT Networks & Protocols
IT		
9	IT331	Cyber Security
Mechanical		
10	ME331	Finite Element Analysis
11	ME332	Kinematics & Dynamics of Robots
12	ME333	Facility Planning & Design

Open Elective (OE) :Term - I (List of courses for Academic Year 2019-20)		
Chemical		
1	CH421	Process Synthesis, Design and Optimization
2	CH422	Piping Design & Engineering
Civil		
3	CV421	Financial Management
Computer		
4	CS421	Data Science-II
5	CS422	Pattern Recognition
Electronics		
6	EX421	Robotics Vision and Control
E & TC		
7	ET421	Low-Power SoC Architecture & Applications (SoC&A)
8	ET422	Privacy and Security in IoT
IT		
9	IT421	Ethical Hacking & Cyber Laws
Mechanical		
10	ME421	Computational Fluid Dynamics
11	ME422	Robotics Control
12	ME423	Operations Management

Open Elective (OE) :Term - II (List of courses for Academic Year 2019-20)		
Chemical		
1	CH451	Process Intensification & Integration
2	CH452	Pipeline Engineering
Civil		
3	CV451	Operation Research
Computer		
4	CS451	Practitioner's approach for Data analytics
5	CS452	Reinforcement Learning
Electronics		
6	EX451	Intelligent and High-Performance Robotics
E & TC		
7	ET451	Real-Time Embedded System (RES)
8	ET452	Energy Management for IoT Devices
IT		
9	IT451	Cyber Forensics
Mechanical		
10	ME451	Advanced Engineering Analysis
11	ME452	Robotic Actuators
12	ME453	Supply Chain Management

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

Skill Development and Project (SDP) : 10 Courses		
Sl. No.	**Course Code**	**Course**
1.	ME102	Engineering Tools and Techniques
2.	ME103	Design Thinking
3.	ET206	Prototyping
4.	CH213	Minor Project
5.	CH304	Skill development Lab.
6.	CH324	Mini Project
7.	CH402	Skill development Lab 2
8.	CH403	Project - I
9.	CH404	Summer Internship
10.	CH432	Project - II

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MIT ACADEMY OF ENGINEERING, ALANDI

An Autonomous Institute Affiliated to

Savitribai Phule Pune Univeristy

Curriculum

For

First Year

Bachelor of Technology

2016-2020

(With Effect from Academic Year: 2016-2017)

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE STRUCTURE (2016 - 2020)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2016-17
FIRST YEAR BACHELOR OF TECHNOLOGY	RELEASE DATE	:	1/06/2016
	REVISION NO.	:	0.0

SEMESTER: I

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

SEMESTER: II

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	NSC3	AS104	Mathematics – 2	4	1	5
2.	NSC4	AS103 / AS102	Chemistry / Physics	3	2	4
3.	ESC3	CV101 / EX101	Applied Mechanics / Electrical& Electronics Engg.	3	2	4
4.	ESC4	IT101 / ME101 /	Computer Programming / Engineering Graphics	2	4	4
5.	HSS2	HP102	Language & Communication – 2	1	2	2
6.	SDP2	ME103 / ME102	Design Thinking / Experimental Tools & Techniques	---	4	2
TOTAL				**13**	**15**	**21**

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

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

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

PRE-REQUISITE : Basic elementary Mathematics of XI & XII

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

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

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

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

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

TEXT BOOK

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

REFERENCE BOOK

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

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

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

AS102.CEO.1: To make students identify the basic concept of measurements and to formulate problems in physical and mathematical terms.(L3).

AS102.CEO.2: To analyze and understand the behavior of light as a wave and get acquaint with different applications in Physics.(L4).

AS102.CEO.3: To apply the concept of behavior of light and understand the polarization phenomena.(L3) .

AS102.CEO.4: To classify and understand the difference of classical mechanics and quantum mechanics.(L2).

AS102.CEO.5: To derive the basic laws governing the motion of quantum particles.(L4).

AS102.CEO.6: To apply the concept of quantum mechanics to different applications and supplement the reasoning vis--vis understanding of different branches of Physics.(L3).

COURSE OUTCOMES :

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

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

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

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

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

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

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

THEORY

UNIT 1	**Measurement and importance of span (order) of physical quantities**	**7 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 with specific examples of Gravitational constant(G), Speed of light(c),Planks constant(h), Boltzmann constant(k) and wavelengths of electromagnetic spectrum. Importance of the orders of G, c, h and k alongwith hypothetical picture of world in case of their order becomes unity (1). Length-scale and time-scale of specific physical phenomenon.

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 Light**	**6 HOURS**

Polarization of light, Production and analysis of polarized light (Brewsters law, Law of Malus), Optical Activity, Specific Rotation due to optically active solutions, Application of Polarized light.

UNIT 4	**Quantum Mechanics-I .**	**8 HOURS**

Shortcomings or failure of Classical Mechanics with specific example of blackbody radiation, Plancks quantum law of blackbody radiation, Matter-waves, De-Broglies concept of matter waves, Heisenbergs Uncertainty Principle, Operators, Eigen values and Eigen functions, Expectation Values, Wave-function, Physical significance of wave function.

UNIT 5	Quantum Mechanics-II .	8 HOURS
Schrodingers equations, Time Dependent and Time Independent forms of Schrodinger Equations, Applications of Schrodinger Equation, Electron in an infinite potential well (rigid box), Electron in a finite deep potential well (non-rigid box) and concept of quantum mechanical tunneling, Application of electron in a potential well in case of Bohrs atomic model.		

UNIT 6	Applications of Quantum Mechanics-LASER .	6 HOURS
Stimulated Emission of light and its comparison with spontaneous emission, Probabilities of stimulated absorption and emission of light (Einsteins coefficients), Principle and working of LASER with example, Application of LASER in optical fibre communication.		

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

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

TEXT BOOK

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

REFERENCE BOOK

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	**AY:** 2016 - 2017
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Chemistry
	COURSE CODE	AS103
	COURSE CREDITS	4
RELEASED DATE : 01/06/2016	**REVISION NO**	0.0

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

PRE-REQUISITE : Basic Chemistry of XI and XII

COURSE OBJECTIVES :

AS103.CEO.1: To summarize the basic chemistry and classic methods of analysis, which includes solution, concentrations and indicators.

AS103.CEO.2: To outline the technology involved in improving quality of water for its industrial use.

AS103.CEO.3: To illustrate the basic concepts of analytical techniques that facilitates rapid and reliable measurements.

AS103.CEO.4: To demonstrate the use of ultra violet visible spectroscopy as invaluable tools in synthetic chemistry.

AS103.CEO.5: To list and explain the principle & techniques of separation methods.

AS103.CEO.6: To define the basic aspects of advanced materials & their applications.

COURSE OUTCOMES :

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

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

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

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

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

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

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

THEORY

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

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

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

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

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

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

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

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

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

TEXT BOOK

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

REFERENCE BOOK

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

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

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

PRE-REQUISITE :

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

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

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

PRACTICALS : Total 8 Experiments from two groups.		
PRACTICAL NO.01	**Kirchhoffs laws and Superposition theorem**	**2 HOURS**
To develop a circuit for Kirchhoffs laws and Superposition theorem. To build and test it.		
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 lagging and leading power factor To find power losses in R, L and C.		
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. To connect Bulb load in Delta connection and verify the relation.		
PRACTICAL NO.05	**Open circuit & Short circuit test on a Single Phase transformer**	**2 HOURS**
To find iron loss and no load current To find full load copper loss and winding parameters To determine efficiency and regulation of transformer		
PRACTICAL NO.06	**Load test on D.C. Shunt Motor.**	**2 HOURS**
To find the torque and output power of motor To calculate the efficiency of motor.		
PRACTICAL NO.07	**Step angle control of Stepper motor.**	**2 HOURS**
To gain familiarity with the properties of stepper motors. To calculate the step angle of motor.		
PRACTICAL NO.08	**Speed control of BLDC/PMDC Motor.**	**2 HOURS**
To find the relation between voltage and speed of motor To develop any small application.		
PRACTICAL NO.09	**Electronics Components and Measuring instruments:**	**2 HOURS**
To study Passive components Resistors, Capacitors & Inductor. To test semiconducting components Diode, BJT To measure various electronic quantities using CRO, Function generator, DMM		
PRACTICAL NO.10	**DC Regulated Power Supply:**	**2 HOURS**
To design 12V IC based DC regulated power supply (Theoretically). To test and observe waveforms at various stages on CRO and measure the voltage using DMM.		
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 OPAMP as summing and difference amplifier. To verify the application of OPAMP 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(Minimum 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.		

TEXT BOOK

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

REFERENCE BOOK

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

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

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

PRE-REQUISITE : Physics and Mathematics of XI & XII

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

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

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

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

TEXT BOOK

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

REFERENCE BOOK

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	**AY:** 2016 - 2017
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Engineering Graphics
	COURSE CODE	ME101
	COURSE CREDITS	4
RELEASED DATE : 01/06/2016	**REVISION NO**	0.0

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

PRE-REQUISITE :

COURSE OBJECTIVES :

ME101.CEO.1: To impart knowledge about principles/methods related to projections of one, two and three-dimensional objects.
ME101.CEO.2: To develop & apply visualization skill to simple Objects.
ME101.CEO.3: To expose students to computer aided drafting tools.

COURSE OUTCOMES :

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

ME101.CO.1: Recall fundamentals of projections (L1)
ME101.CO.2: Interpret engineering drawings (L2)
ME101.CO.3: Apply visualization skill to draw various views of object (L3)
ME101.CO.4: Analyzeengineeringdrawings (L4)
ME101.CO.5: Decide annotations for two dimensional drawings (L5)
ME101.CO.6: Develop and/or comprehend a simple engineeringdrawing in both First and Third angle orthographic projections(L4)

THEORY		
UNIT 1	**Visual Thinking & Solid Geometry**	**5 HOURS**
Essentials of engineering graphics including technical sketching, Projection of Line, Plane, Solid.		
UNIT 2	**Orthographic Projections & Sectional Views**	**5 HOURS**
Reference Planes, Types of Orthographic Projections, Sectional Orthographic Projections, Sectional Views.		
UNIT 3	**Isometric Projections**	**5 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	**Interpretation of given view/ missing view**	**5 HOURS**
Identification of lines/ edges and surfaces, visualization of given orthographic views, adding missing/ third view, adding a sectional view, to convert a given view into sectional view.		
UNIT 5	**Auxiliary Projections**	**4 HOURS**
Auxiliary Planes- Auxiliary Vertical Plane, Auxiliary Inclined Plane, Symmetrical Auxiliary View, Unilateral Auxiliary View, bilateral Auxiliary View.		
UNIT 6	**Freehand Sketching & 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.		

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

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

TEXT BOOK

1. Dhanajay A. Jolhe, Engineering Drawing with an introduction to Auto CAD, 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 Text Book 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 SYLLABI (2016 – 2020)	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	**AY:** 2016 - 2017
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Computer Programming
	COURSE CODE	IT101
	COURSE CREDITS	4
RELEASED DATE : 01/06/2016	**REVISION NO**	0.0

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

PRE-REQUISITE : Knowledge of computer system.

COURSE OBJECTIVES :

IT101.CEO.1: To define and summarize the basic terminologies used in computer programming.
IT101.CEO.2: To develop and demonstrate logic for a given problem using algorithms and Flowcharts.
IT101.CEO.3: To evaluate solutions for the given problem using problem solving tools.
IT101.CEO.4: To identify and analyze different control structures.
IT101.CEO.5: To understand and use of simple data structures using Python.
IT101.CEO.6: To demonstrate and understand different computer applications in engineering.

COURSE OUTCOMES :

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

IT101.CO.1: Analyze a problem and identify and define the computing requirements appropriate to its solution[L3][L4].
IT101.CO.2: Apply the knowledge and strategies for structuring code, dividing problems up into pieces that can be solved independently, then integrating the pieces into a whole to solve a large problem [L3].
IT101.CO.3: Analyze when to select the different types of data structures such as arrays and lists as a framework for solving a problem [L4].
IT101.CO.4: Design, correctly implement and document solutions to problems using Python [L6].
IT101.CO.5: Analyze and compare alternative solutions to computing problems [L2][L4]
IT101.CO.6: Adapt to new developments in the field of computer science [L6].

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

PRACTICALS		
PRACTICAL NO.01		**6 HOURS**
1. Find the result of allthe arithmetic operations (Addition,Subtraction,Multiply, Division and modulo) in Python. 2. Show the distance in miles per gallon with respect user defined value in Python. 3. Find the kinetic energy of an object.		
PRACTICAL NO.02		**6 HOURS**
1. Write a Python program for printing result of five subjects for five students. 2. Choose any value and find whether the number is even or odd. 3. Identify whether the number entered by user is prime or not.		

PRACTICAL NO.03		6 HOURS
1. Solve the Fibonacci sequence using recursive function in Python. 2. Illustrate factorial of non-negative numbers in Python. 3. Build asterisk (*) graph in Python		
PRACTICAL NO.04		**6 HOURS**
Electric circuits, Chemical applications- Mixing problems.		
PRACTICAL NO.05		**6 HOURS**
1. Select the number from the entered list and find its position in Python (use Linear Search). 2. Select the number and find its position of in Python (use Binary search). 3. Choose cricket team of eleven players find the captain of the team (consider tallest person as a captain)		
PRACTICAL NO.06		**6 HOURS**
1. Select a text file and count number of words, repeated words in a file. 2. Choose the words from the file, store in the list and sort the list is ascending order. 3. Create duplicate the file from an original file.		
PRACTICAL NO.07		**6 HOURS**
1. Predict whether the entered string is palindrome or not. 2. Compare two strings and convert in opposite case in Python. 3. Select any two words and perform concatenation operation		
PRACTICAL NO.08		**14 HOURS**
1. Create a simple picture in python using graphics package. 2. Construct 2D and 3D plotting the Objects. 3. Create Sine waveform, Cosine waveform, Square waveform, Saw-tooth waveform, using MATLAB and discrete the same. 4. Solve the matrix operations (Addition, Multiplication, and Transverse) in MATLAB. 5. Design an application to display student result using predictive analysis		

TEXT BOOK

1. 1. Problem Solving and Programming Concepts ,Maureen Sprankle , Pearson Publication, Seventh Edition, ISBN 81-317-0711-3.
2. How to think like a Computer Scientist, Learning with Python Allen Downey, Jeffrey Elkner, Chris Meyers, Green Tea Press ISBN: 0-9716775-0-6.

REFERENCE BOOK

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

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

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

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

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

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

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

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

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

REFERENCE BOOK

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

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

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

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

PRACTICALS		
PRACTICAL NO.01	**Information Technology/Computer Engineering (Minimum 6 practicals from the following**	**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 creation of a web site using Google sites.

PRACTICAL NO.02	**Electronics Engineering (Minimum 6 practicals from the following**	**12 HOURS**

1. Basic electronics component and switches
2. PCB and Soldering Tools And Technique
3. Relay and application
4. Manufacturing of extension board/Spike Guard
5. Series and parallel connection of Electrical Load
6. Actuators and application (Electrical and Mechanical).
7. PCB Wizard
8. Proteus
9. Virtual Instrumentation.
10. Cathode Ray Oscilloscope
11. Power Supply

PRACTICAL NO.03	Mechanical Engineering Laboratories (Minimum 6practicals from the following	12 HOURS

1. Linear and angular measurements.
2. Types of mechanism and making any one mechanism containing four links using card board.
3. Open a household component and explain it with free hand sketches.
4. Draw the outline of the problem identified for project on software package.
5. Measurement of RPM of rotating machine using contact and non-contact type tachometer.
6. Measurement of transmission ratio in Belt drive, Chain drive, and Gear drive.
7. Measurement of Barometric pressure, introduction to pressure measuring devices like bourdon tube pressure gauge and manometer. Fabrication of simple type manometer.
8. Introduction to temperature measuring devices. Making and calibration of thermo couple and using it with temperature indicator.
9. Measurement of Relative humidity of air in the lab.
10. Measurement of hardness of Steel and Aluminum.
11. Measurement of stiffness of helical spring (compression or tension). Open IT
12. Mixer or kitchen machine/ Printer.
13. Refrigerator/ Window Air Conditioner.
14. Boiler and accessories / thermal power plant (Mini).
15. Two stroke or four stroke engine.
16. Assembly and Disassembly of parts in any software package.
17. Introduction to threaded fasteners and joints using threaded fasteners.

PRACTICAL NO.04	Chemical Engineering (Minimum 3 practicals from the following	06 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. Production of Biodiesel
9. Open and Study Heat Exchangers.
10. Water purifier (Household)

PRACTICAL NO.05	Civil Engineering (Mimimum 3 Practicals from the following)	06 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 housing 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 lifesaving dos and donts during the different natural calamities.
9. To demonstrate the dos and donts after different natural calamities.

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 SYLLABI (2016 – 2020)	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	**AY:** 2016 - 2017
FIRST YEAR BACHELOR OF TECHNOLOGY	**COURSE NAME**	Design Thinking
	COURSE CODE	ME103
	COURSE CREDITS	2
RELEASED DATE : 01/06/2016	**REVISION NO**	0.0

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

PRE-REQUISITE : -

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

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

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

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

TEXT BOOK

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

Web references

1. www.designcouncil.org.uk
2. www.surveymonkey.com
3. http://en.red-dot.org

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

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

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

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

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

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

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

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

TEXT BOOK

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

REFERENCE BOOK

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

5. Advanced Engineering Mathematics by Dennis G. Zill& Warren S. Wright; Jones and Bartlett Publishers, 4th edition, ISBN-10: 0-7637-7966-0, ISBN 13: 978-0-7637-7966-5.

6. Higher Engineering Mathematics by B.S. Grewal (ISBN:81-7409-195-5,Khanna Publications,39 th edition)

7. Applied statistics and probability for engineers fourth edition by Douglas C. montgomery , George C runger(ISBN No:978-81-265-2315-3 wiley)

8. Miller& Freunds Probability and statistics for engineers by richard A johnson, irwin-miller,johnfreund(ISBN no:978-93325-5041-4,Pearson)

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

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

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

COURSE OBJECTIVES :

HP102.CEO.1: To familarise the students with sounds in English and introduce phonemic transcription.

HP102.CEO.2: CEO.2: To enrich the vocabulary of the students with AWL and NAWL.

HP102.CEO.3: To acquaint the students with public speaking, presentation and interview skills in English.

HP102.CEO.4: To develop the students reading and listening skills with the use of written audio and video texts.

COURSE OUTCOMES :

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

HP102.CO.1: Recognise and reproduce the sounds in English effectively. [L1]

HP102.CO.2: Choose and employ appropriate words from AWL and NAWL in communication. [L1, L3]

HP102.CO.3: Express their ideas effectively and demonstrate skills in interpersonal communication. [L2, L3]

HP102.CO.4: Analyse and infer from written, audio and video texts. [L 2, L4]

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

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

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

REFERENCE BOOK

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

MIT | Academy of Engineering

MIT ACADEMY OF ENGINEERING, ALANDI

An Autonomous Institute Affiliated to

Savitribai Phule Pune Univeristy

Curriculum

For

Second Year

Bachelor of Technology in Chemical Engineering

2016-2020

(With Effect from Academic Year: 2017-2018)

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE STRUCTURE (2016 - 2020)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2017-18
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEEERING	RELEASE DATE	:	1/06/2017
	REVISION NO.	:	0.0

SEMESTER: III

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	PC1	CH201	Environmental Science	2	2	3
2.	PC2	AS201	Applied Mathematics	3	2	4
3.	PC3	ET201	System Engineering	3	2	4
4.	DC1	CH202	Material and Energy Balance	3	2	4
5.	DC2	CH203	Chemical Engineering Operations	3	2	4
6.	SDP3	ET206	Prototyping	---	4	2
TOTAL				**14**	**14**	**21**

SEMESTER: IV

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	HSS3	HP201	Psychology	3	---	3
2.	PC4	IT201	Engineering Informatics	3	2	4
3.	PC5	ME201	Material Engineering	3	2	4
4.	DC3	CH211	Momentum Transfer	3	2	4
5.	DC4	CH212	Advanced Chemistry	3	2	4
6.	SDP4	CH213	Minor Project	---	4	2
TOTAL				**15**	**12**	**21**

L: Lecture, P: Practical

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2017 - 2018
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Environmental Science
	COURSE CODE	CH201
	COURSE CREDITS	3
RELEASED DATE : 01/06/2017	**REVISION NO**	0.0

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

PRE-REQUISITE : AS103: Chemistry

COURSE OBJECTIVES :

CH201.CEO.1: Give an overview of exploitation of various natural resources and its impact on the environment.
CH201.CEO.2: Understand the ecosystem and biodiversity.
CH201.CEO.3: Understand the importance of environment and its conservation.
CH201.CEO.4: Learn about the environmental pollution sources, effects and control measures.
CH201.CEO.5: Make aware of the national and international issue for the environment.
CH201.CEO.6: Make aware about the social and environmental responsibility.

COURSE OUTCOMES :

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

CH201.CO.1: Identify the various human activities adversely affecting the natural resources and the balance ecosystem.
CH201.CO.2: Observe the various aspects of ecosystems and suggest ways to protect them.
CH201.CO.3: Experiment the pollution of given locality and suggest steps to mitigate pollution.
CH201.CO.4: Record the sources of pollution and their controls.
CH201.CO.5: Compare laws and standards for pollution.
CH201.CO.6: Categorize the social and professional responsibility towards environment.

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

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

TEXT BOOKS

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

REFERENCE BOOKS

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

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

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

PRE-REQUISITE :

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

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

THEORY		
UNIT 1	**Laplace Transform I**	**6 HOURS**
Introduction of Laplace Transform, Properties: First shifting, Second shifting, Change of scale, Linearity, Multiplication by t, Division by t. Laplace Transform of derivatives, integration, Unit Step function, Impulse Function and Periodic Functions.		
UNIT 2	**Laplace Transform II**	**6 HOURS**
Introduction of Inverse Laplace Transform, Properties: First shifting, Second shifting, Change of scale, Linearity, Multiplication bys, Division bys. Inverse Laplace Transform of elementary functions, Derivatives, Integration. Use of partial fractions to find Inverse Laplace Transform. Solution and analysis of linear differential equation to linear system.		
UNIT 3	**Fourier Series**	**6 HOURS**
Periodic functions, Fourier series, Dirichlets conditions, determination of Fourier constants, Half ranges series, Even function series, odd function series, arbitrary period functions series.		
UNIT 4	**Fourier Transform**	**6 HOURS**
Introduction of Fourier Transform, Complex exponential form of Fourier series, Fourier Integral Theorem (without proof), Fourier transform and its properties, Fourier Sine Transform, Fourier Cosine Transform, and Inverse Fourier transforms, Fourier Transform of derivatives of a function, Analysis of frequency response.		
UNIT 5	**Applications of Partial differential Equations**	**6 HOURS**
One dimensional Heat flow and wave equations by method of separation of variables, Solution of Partial Differential equations by Numerical method: Crank Nicolson method.		
UNIT 6	**Numerical Methods**	**6 HOURS**
Interpolation: Finite Differences, Newtons and Lagranges Interpolation. Numerical solution of System of linear equations by Gauss elimination method and Ordinary differential equations by Eulers, Modified Eulers, Runge-Kutta 4th order methods.		

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

REFERENCE BOOK

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF ELECTRICAL ENGINEERING	**W.E.F**	**AY:** 2017 - 2018
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	System Engineering
	COURSE CODE	ET201
	COURSE CREDITS	4
RELEASED DATE : 01/06/2017	**REVISION NO**	0.0

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

PRE-REQUISITE :

1: ME102 Engineering Tools and Techniques
2: ME103 Design Thinking

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

ET201.CO.1: Explain the rationale for using systems thinking for complex adaptive systems.
ET201.CO.2: Analyze interaction with stakeholders in a participatory way for research study.
ET201.CO.3: Design System Engineering framework.
ET201.CO.4: Apply system engineering tools.
ET201.CO.5: Evaluate the system.

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

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Community based causal mapping – Developing causal loop diagrams for health care using Vensim.		
PRACTICAL NO.02		**2 HOURS**
Developing stock-and-flow diagrams for health care system using Vensim.		
PRACTICAL NO.03		**2 HOURS**
(Any 02) 1. Unmanned aerial vehicle 2. Conduct some research into the London building known as the Walkie Scorchie. Identify what circumstances led to the building earning that unfortunate name and suggest which aspects of the systems engineering process may not have been followed correctly (at least as the issues have been reported in the media).The following links may assist in your investigations. http://www.dezeen.com/2013/09/06/we-made-a-lot-of-mistakes-with-this-building-says-walkie-scorchie- architect-vinoly/ http://www.ibtimes.co.uk/walkie-scorchie-talkie-building-sunlight-london-reflects-504342. 3. Examine in detail the BRT of New Delhi,Identify what circumstances led to the failure of the system. 4. Garbage collection 5. Washing machine		
PRACTICAL NO.04		**2 HOURS**
Determine the typical structure and contents of the system requirements specification (SyRS) for any one of the case study.		
PRACTICAL NO.05		**2 HOURS**
Choose an example related to your own discipline and then list and describe three detailed design tools to come up with a satisfactory design for anyone of the case study.		
PRACTICAL NO.06		**2 HOURS**
We want to modify our house (or from any one of the case studies) by for futuristic requirement to accommodate your children after marriage.Explain how accurate technical data on the house (as confirmed by PCA and FCA) supports this modification. Explain how the early design stages could have assisted with this modification if expandability/ future growth had been accounted for.		
PRACTICAL NO.07		**2 HOURS**
Mini project based on society, science and technology problem clubbed with Field visit and presentation (Define problem, data collection, requirement analysis,functional analysis.Design solution, progressive presentation of solution and final presentation). Note: The group of students should be from different program (Multidisciplinary group).		

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

TEXT BOOK

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

REFERENCE BOOK

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2017 - 2018
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Material and Energy Balance
	COURSE CODE	CH202
	COURSE CREDITS	4
RELEASED DATE : 01/06/2017	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	30	50	20	25	25	150

PRE-REQUISITE : -

COURSE OBJECTIVES :

CH202.CEO.1: Develop ideas in dimensional analysis and to be familiar with different unit systems and conversion from one set of system to another.

CH202.CEO.2: Understand the various unit operations and unit processes performed in chemical industry.

CH202.CEO.3: Learn the fundamentals of stoichiometry.

CH202.CEO.4: Apply different laws of conservation to solve material and energy balance problems.

CH202.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,

CH202.CO.1: Interpret the data presented in different unit systems.

CH202.CO.2: Apply the various gas laws to calculate the unknowns in the given system.

CH202.CO.3: Develop the material balance equation for the given system.

CH202.CO.4: Analyze the heating value of the given fuel.

CH202.CO.5: Calculate the heat of reaction for the given reaction at the specific conditions.

CH202.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, percent 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.		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Estimation of the normality of the given unknown solution.		
PRACTICAL NO.02		**2 HOURS**
Estimation of the molarity of the given unknown solution.		
PRACTICAL NO.03		**2 HOURS**
Estimation of the composition of the given liquid mixture using the specific gravity of the mixture.		
PRACTICAL NO.04		**2 HOURS**
Identification of the Feed requirement for the given output (Mixing).		
PRACTICAL NO.05		**2 HOURS**
Identification of the limiting reactant, Excess reactant and percent excess in the given acid base reaction.		

PRACTICAL NO.06		**2 HOURS**
Using Psychrometric chart, find the properties of air water vapor mixture.		
PRACTICAL NO.07		**2 HOURS**
Estimation of the calorific value of the given fuel using Bomb Calorimeter.		
PRACTICAL NO.08		**2 HOURS**
Analysis of flue gases by Orsat Apparatus.		
PRACTICAL NO.09		**2 HOURS**
Estimation of percent conversion for a given reaction.		
PRACTICAL NO.10		**2 HOURS**
Estimation of heat of reaction.		
PRACTICAL NO.11		**2 HOURS**
Estimation of the density of the given composition liquid mixture.		
PRACTICAL NO.12		**2 HOURS**
Identification of the product streams for given feed (Separation).		

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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2017 - 2018
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Chemical Engineering Operations
	COURSE CODE	CH203
	COURSE CREDITS	4
RELEASED DATE : 01/06/2017	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	30	50	20	25	25	150

PRE-REQUISITE : -

COURSE OBJECTIVES :

CH203.CEO.1: Comprehendenergy requirement calculation for size reduction and for mixing equipment.
CH203.CEO.2: Evaluate principles, working of various equipment used in filtration, Mixing etc.
CH203.CEO.3: Understand Conveyors types with application.
CH203.CEO.4: Analyze various unit operation and Selection of proper equipment for given requirement.
CH203.CEO.5: Know the significance and usage of different particulate characterization parameters, and equipment to estimate them.
CH203.CEO.6: Design fluidized systems and application of fluidized bed in industry.

COURSE OUTCOMES :

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

CH203.CO.1: Apply basics of mechanical operations to solve chemical plant problems.
CH203.CO.2: Classify size reduction, mixing and separation equipment.
CH203.CO.3: Calculate power requirement for various equipment with laws.
CH203.CO.4: Competent to understand working of filtration and mixing.
CH203.CO.5: Analyze filtration data to select systems based on requirements.
CH203.CO.6: Design fluidized bed systems for industrial application.

THEORY COURSE CONTENT		
UNIT 1	**Particle Screening and size reduction**	**7 HOURS**
Particle size and shape, Mixtures of particles, Determination of particle size, Standard screen series, screen analysis, Screen effectiveness and capacity, Industrial screening equipment. Crushing efficiency, energy requirements calculations by using different crushing laws, Size reduction equipment: 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.		
UNIT 3	**Mixing and Agitation**	**8 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	**Flow through Packed Beds and Fluidization**	**7 HOURS**
Flow through packed beds (Kozeny-Carman and Erguns Equation), characteristics of fluidized systems, minimum fluidization velocity, types of fluidization Geldarts powder classification and applications of fluidization technique, 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**	**7 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, equipment 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**
Screening of Sand		
PRACTICAL NO.02		**2 HOURS**
Jaw Crusher		
PRACTICAL NO.03		**2 HOURS**
Ball Mill		
PRACTICAL NO.04		**2 HOURS**
Effectiveness of Screens		
PRACTICAL NO.05		**2 HOURS**
Properties of Solids		
PRACTICAL NO.06		**2 HOURS**
Trommel		
PRACTICAL NO.07		**2 HOURS**
Power consumption in agitated vessel		
PRACTICAL NO.08		**2 HOURS**
Leaf filter		
PRACTICAL NO.09		**2 HOURS**
Plate and frame filter press		
PRACTICAL NO.10		**2 HOURS**
Cyclone		
PRACTICAL NO.11		**2 HOURS**
Bucket Elevator		
PRACTICAL NO.12		**2 HOURS**
Belt Conveyor		
PRACTICAL NO.13		**2 HOURS**
Sigma Mixer		
PRACTICAL NO.14		**2 HOURS**
Froth Floatation		
PRACTICAL NO.15		.
Industrial Visit		

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 autonomouse Institute Affilated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF COMPUTER ENGINEERING AND TECHNOLOGY	**W.E.F**	**AY:** 2017 - 2018
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Prototyping
	COURSE CODE	ET206
	COURSE CREDITS	02
RELEASED DATE : 01/06/2018	**REVISION NO**	1.0

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

PRE-REQUISITE :

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

COURSE OBJECTIVES :

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

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

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

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

COURSE OUTCOMES :

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

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

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

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

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

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. Electronic Prototyping (EP)
3. Software Prototyping(SP)
4. Civil Prototyping(CP)

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 all four course modules will be averaged and if student secures passing marks (passing grade) after averaging; then the required credits of the course will be earned.

MODULE: 1/4	**Mechanical Prototyping (MP)**	**28 HOURS**

PRACTICAL:

PRACTICAL NO. 01	**Introduction to prototyping**	**02 HOURS**

1. Introduction to Prototyping, traditional prototyping vs. advance rapid Prototyping, different types of prototyping techniques (clay modeling, casting, carpentry, metal art etc.) and their working principle.
2. Suitable materials and their properties.
3. Applications and need of prototype in emerging field like Bio - medicals, defense, manufacturing, aerospace etc.
4. Formation of a group of 5 students per project team.

PRACTICAL NO. 02	**Design of models**	**04 HOURS**

1. Introduction of CAD software and its interaction with prototype machine.
2. 3D Modeling using CAD software package.
3. Identify physical constraints of prototyping

PRACTICAL NO. 03	Preprocessing of prototype	06 HOURS

1. Generating STL files from the 3D models & working on STL files.
2. Pre-Processing the 3D Model in KISslicer / Cuba software.
3. Suitable filament selection and its properties.

PRACTICAL NO. 04	Orientation and support generation	04 HOURS

1. Operate Repeater / Cuba software, Selection of Orientation, Supports generation.
2. Slicing pattern, tool path generation, G Code and gives input to prototype machine for actual part/object manufacturing.

PRACTICAL NO. 05	Assembly of model	08 HOURS

1. Complete machine setup.
2. Hands on experience of rapid prototype machine for part/object, assembly manufacturing.
3. Material selection, cost benefit analysis for prototyping, financial aspect.

PRACTICAL NO. 06	Project presentation	04 HOURS

1. Final Presentation and 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: 2/4	Electronic Prototyping (EP)	28 HOURS
PRACTICAL:		
PRACTICAL NO. 01	**Introduction to design and construction of electronic prototyping**	**02 HOURS**

1. Gain familiarity with basic stages; Conceptualization, Detailed Design and Implementation.
2. Acquire concepts of basic processes in electronic prototyping.
3. Form a group of students. (03 max)
4. Perform Brainstorming and develop a simple electronic product idea based on given pre-declared theme in given time span.
5. 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.
   - Using cable ties , heat shrink tubes, sleeves and other wire dressing techniques.
3. Breadboard
   - Bending wires and making connections on breadboards.
   - Placing components on breadboards.
   - Testing circuits using breadboards.
4. Perfboards
   - Wire connections and component assembly on perfborads.
   - Debugging assembled circuit and increasing stability.

PRACTICAL NO. 03	PCB design using basic Electronic Design Automation (EDA)tools	04 HOURS

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

PRACTICAL NO. 04	PCB fabrication	08 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 as per IPC 610 D.
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.

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.

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: 3/4	**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	**Design UML Diagrams for given problem statement**	**04 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. 03	**Requirement analysis**	**04 HOURS**

1. Find the requirement specification of given problem statement and formulate the feasible solution.
2. Paper (low-fidelity) prototype: choose the interface intend to develop, giving the reasons (pros and cons) and describing it summarily - choose the similar interface, indicating its key characteristics.

PRACTICAL NO. 04	Design analysis	06 HOURS

1. Make an Inspiration board.
2. Start an inspiration board by listing 5-10 words that relate to your design idea or point of view. These words can be anything – from similar designs to feelings that the idea evokes.
3. Once you've listed your words, come up with at least five inspirations, and share them by providing links or images within your assignment submission. For each inspiration, give a brief (1-2 sentences) and insightful explanation of why you chose it (What did you take away from it? What did you learn from it. In other words, why did it inspire you?). Each of these inspirations should offer a different perspective to the design you are working on.

PRACTICAL NO. 05	Design analysis	06 HOURS

1. Create Storyboards
2. A storyboard is a comic-strip-like set of drawings about what interface does and how it is used to accomplish tasks in a real usage scenario. A good storyboard should clearly demonstrate who the user is, the usage situation, and the user's motivations for using the interface. It should show what the user can accomplish with interface, but it needn't (and often shouldn't) show a specific user interface design. For a storyboard including an app screen, the details of the screen are not relevant, but what those screens enable you to accomplish is. Each storyboard should comprise 5-8 panels and will provide all details of end product.

PRACTICAL NO. 06	Presentation	04 HOURS

1. Each group will be given 10 min to present their work.

REFERENCE BOOK

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

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

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

REFERENCE BOOK

1. Vector mechanics for Engineers: statics and dynamics by Beer Johnston 10th edition, McGraw Hill Education , ISBN: 978-0073398242
2. Bamboo Architecture Design (Architecture Materials), by Chris van Uffelen, , ISBN: 978-3037681824
3. Designing and Building with Bamboo ,Jules J.A. Janssen Technical University of Eindhoven Eindhoven, The Netherlands, ISBN 978-8186247464
4. Codes and standards
   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.

REFERENCE

1. Paris Agreement(http://unfccc.int/paris$_a$*greement/items*/9485.*php*)
2. Kyoto Protocol(http://unfccc.int/kyoto$_p$*rotocol/items*/2830.*php*)
3. Green Building Objectives Checklist, Auroville Bamboo Centre, Puducherry, Tamilnadu.(http://aurovillebamboocentre.org/)

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	**AY:** 2017 - 2018
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Psychology
	COURSE CODE	HP201
	COURSE CREDITS	3
RELEASED DATE : 01/06/2017	**REVISION NO**	0.0

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

PRE-REQUISITE :

COURSE OBJECTIVES :

HP201.CEO.1: To introduce the basic concept and scope of Organizational Behavior.
HP201.CEO.2: To teach the theory of personality and its implications in the organization.
HP201.CEO.3: To evince types and styles of Leadership and the impact of values on the same.
HP201.CEO.4: To guide learners through a decision making process.
HP201.CEO.5: To enhance participants skills when practicing team work concepts through business games.
HP201.CEO.6: To introduce the concept of Motivation and constructive ways of coping.

COURSE OUTCOMES :

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

HP201.CO.1: Explain human behavior in the workplace from an individual, group, and Organizational perspective.
HP201.CO.2: Develop an ability to analyze ones own personality and that of others in Organizations.
HP201.CO.3: Compare different leadership styles with an understanding of how core values affect Leadership.
HP201.CO.4: Demonstrate decision making ability
HP201.CO.5: Identify the problems associated with organizing and managing teams.
HP201.CO.6: Comprehend the correlation amongst stress, motivation and personality.

THEORY

UNIT 1	Organizational Behaviour	6 HOURS

Meaning of Psychology and Organizational Behaviour, Psychology in Organization: History of Organizational Psychology; Scope and Research in Organizational Behaviour, Structure of Organization, Organizational culture, Strong vs Weak culture, Culture vs Formalization.

UNIT 2	Perception and Decision Making	6 HOURS

Meaning, process and determinants of Perception, Process of Decision Making, The link between Perception and Individual Decision Making, Influences on Decision Making: Individual Differences & Organizational constraints, Process and ethics of decision making.

UNIT 3	Personality, Values and Leadership	6 HOURS

What is Personality, The Big Five Personality Model, The importance of values; values and ethical behavior, Leadership, Understanding Personality, values and Leadership, Emotional Intelligence-Personal and Social Competence.

UNIT 4	Understanding Team Work and Conflict Resolution	6 HOURS

Difference between groups and teams, Types of teams, Turning Individuals into Team players, Team building and Team based work, Team dynamics, Types of conflict and conflict resolution.

UNIT 5	Motivation & Stress	4 HOURS

Motivation and its types, Content and Process Theories of Motivation, Concept and reactions to stress, Potential effects of stress, Coping with and managing stress.

TEXT BOOK

1. S. P. Robbins, Organizational Behavior Prentice-Hall India, 1995, ISBN-11:81-203-2875-2.
2. F. Luthans, Organizational Behavior. McGraw-Hill, 1995, ISBN-13: 0072873876.
3. U. Sekarn, Organizational Behavior: Text and Cases, Tata McGraw Hill, 1996, ISBN: 0074603663.
4. Furnham, The Psychology of Behavior at Work, Psychology Press, 1997, ISBN: 1841695041 .

REFERENCE BOOK

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

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

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

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

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

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

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

PRACTICAL :		
PRACTICAL NO.01		**8 HOURS**
In traditional manual information systems, the storage, retrieval, and update operations on elementary data item, records and files are handled manually. In the context of automation, design an information system that summarizes data while providing storage and retrieval facilities for offline analysis. This automated information system should follow: Identification of an interdependent elementary data items which have facts and figures Data collection through sensors Processing using Arduino Data Storage using MySQL in an accessible form Data visualization using graphs		
PRACTICAL NO.02		**8 HOURS**
Over the last year, the three locations of fast-food restaurant have produced mixed financial results. You have been asked to analyze the performance data from each location and identifying the causes of these results. For the same, design the dashboard to monitor key performance indicators for given system. Create a graph showing how revenue evolves throughout the year for each of the sales channels Create an interactive chart that can be used to switch between different sales channels. Create three different views of the data: monthly sales revenue, sales revenue by category, and revenue by the top five distributors.		
PRACTICAL NO.03		**8 HOURS**
Deploy an IoT based automation system for controlling home appliances such as fan, lights, water pumps, etc. using Raspberry Pi. Identify the home appliances that require human interaction for its operations and state the need of automation. Identify system component Design circuit diagram Assemble system components Program the interface System Testing System Deployment		

TEXT BOOK

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

REFERENCE BOOK

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

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

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

PRE-REQUISITE : AS102: Physics, AS103: Chemistry

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

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

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

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

TEXT BOOK

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

REFERENCE BOOK

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2017 - 2018
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Momentum Transfer
	COURSE CODE	CH211
	COURSE CREDITS	4
RELEASED DATE : 01/06/2017	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	30	50	20	25	25	150

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

CH211.CEO.1: Understand the basic concepts of fluid mechanics and its application.
CH211.CEO.2: Understand the fluid statics and principles of various pressure measuring devices.
CH211.CEO.3: Learn the fundamentals of fluid, valves and pumps used in pipelines.
CH211.CEO.4: Know about dimensional analysis and principles of similarity.
CH211.CEO.5: Understand the basic energy balance equations and their applications.
CH211.CEO.6: Learn the basic concepts of flow through pipelines.

COURSE OUTCOMES :

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

CH211.CO.1: Apply concepts of momentum transfer to different processes in chemical engineering.
CH211.CO.2: Find out the dimensions of unknown variable by using dimensional analysis.
CH211.CO.3: Calculate pressure drop by setting momentum balance.
CH211.CO.4: Perform design calculations related to flow measurements and pumping of fluids.
CH211.CO.5: Calculate different losses in piping.
CH211.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, Euler's and Navier - Stoke's equations,flow measurement using venturimeter, orificemeter, rotameter and pitot tube, flow through notchesand weirs.		
UNIT 3	**Flow of incompressible fluid through pipe**	**7 HOURS**
Shear stress distribution, relation between skin friction and wall shear, friction factor, laminar flowthrough circular pipe, on inclined plane, relation between average and maximum velocity, major andminor 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 boundarylayer. Fundamental dimensions of quantities, dimensional homogeneity, dimensional analysis by Rayleighs method and Buckinghams method, dimensionless numbers.		
UNIT 5	**Fluid Moving Machinery**	**7 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	**Pumps and Introduction to CFD**	**7 HOURS**
Governing equations of fluid flow, mass conservation, momentum and energy equation, differentia-land 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		
PRACTICAL NO.03		**2 HOURS**
Calibration of Orifice meter		
PRACTICAL NO.04		**2 HOURS**
Reynolds Experiment		
PRACTICAL NO.05		**2 HOURS**
Verification of Bernouliis equation		
PRACTICAL NO.06		**2 HOURS**
Calibration of Rotameter		
PRACTICAL NO.07		**2 HOURS**
Calibration of Notches		
PRACTICAL NO.08		**2 HOURS**
Minor losses in Pipe flow		
PRACTICAL NO.09		**2 HOURS**
Major losses in Pipe flow		
PRACTICAL NO.10		**2 HOURS**
Characteristics of Centrifugal Pump		
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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2017 - 2018
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Advanced Chemistry
	COURSE CODE	CH212
	COURSE CREDITS	4
RELEASED DATE : 01/06/2017	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	2	30	50	20	25	25	150

PRE-REQUISITE : AS103 Chemistry

COURSE OBJECTIVES :

CH212.CEO.1: Impart the basic concepts of physical and analytical chemistry.
CH212.CEO.2: Develop understanding about concepts on mechanisms of organic reactions.
CH212.CEO.3: Study the different optical, analytical and thermal characterization methods.
CH212.CEO.4: Study the kinetics of various possible chemical reactions and the various factors that influences them.

COURSE OUTCOMES :

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

CH212.CO.1: Predict the mechanism of given organic reaction.
CH212.CO.2: Interpret spectral data & identify unknown compounds.
CH212.CO.3: Predict the rates of given chemical processes.
CH212.CO.4: Apply the knowledge of various Biomolecules used in biochemical processes.
CH212.CO.5: Apply adsorption technique for purification processes.
CH212.CO.6: Apply the knowledge of catalytic techniques used in chemical reaction processes.

THEORY COURSE CONTENT		
UNIT 1	**Kinetics and Phase Rule**	**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) Phase Rule: Gibbs Phase rule & terms involved it with examples. Phase rule for Chemical reaction nquilibrium. One component system- water. Reduced phase rule. Applications & limitations of phase rule.		
UNIT 2	**Biomolecules**	**6 HOURS**
Carbohydrate: Classification, reactions of monosaccharides, D. L configuration, Polysacharidescellulose, starches and their compounds. Amino acids-alpha- amino acids, classification, properties and reactions. Proteins-formation of peptide linkage, features of peptide linkage, alpha-helical configuration, beta-pleated structure. Enzymes - catalytic site of enzyme, factors affecting enzyme activity, classification of enzymes, Enzyme kinetics. Introduction to vitamins and hormones (in brief).		
UNIT 3	**Adsorption & Catalysis**	**8 HOURS**
a) Adsorption: Introduction to Freundlich and Langmuir theories of adsorption, adsorption fromsolution, B.E.T. Theory of adsorption of gases, activation energy, numerical on above. b) Catalysis: characteristics, types, adsorption theory of catalysis, promoters, poisons, industrialapplications of catalysts; acid base catalysis Biological catalysis- Kinetics of enzyme catalysed 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, factorsfavoring 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	**Analytical Techniques**	**7 HOURS**
a) Chromatographic Techniques :GC, GPC, HPLC. b) Spectroscopic Techniques: Infra-red Spectroscopy, FTIR Basic principles, working and applications.		
UNIT 6	**Atomic Spectrometric & Thermal Methods**	**7 HOURS**
a) Atomic Absorption Spectrophotometry & SEM Principles, Instrumentation & applications. b) 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**
Diameter of solute molecule by viscosity measurements.		
PRACTICAL NO.07		**2 HOURS**
To determine the energy of activation of reaction between K2S2O8 & KI.		
PRACTICAL NO.08		**2 HOURS**
Preparation of osazone derivative of glucose.		
PRACTICAL NO.09		**2 HOURS**
Analysis of sample on GC.		
PRACTICAL NO.10		**2 HOURS**
Analysis of sample on HPLC.		
PRACTICAL NO.11		**2 HOURS**
Identification of given organic compound (with maximum one functional group) by systematic analysis.		
PRACTICAL NO.12		**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 : 978812032441.
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. David L Nelson, Lehninger Principles of Biochemistry 4th edition. ISBN 9780716743392.

REFERENCE BOOKS

1. Finar I.L, Organic chemistry, Vol. I and II, ELBS Longman Limited.ISBN : 978817758542.
2. Sykes Peter, Reaction mechanism , 6th Edition, Orient Longman Private Ltd. ISBN : 9780582266445.
3. Lee J.D, Inorganic chemistry , 5th Edition, (ELBS) Chapman & Hall.ISBN : 9780412402906.
4. Cotton, Wilkinson, Basic Inorganic chemistry , 3rd Edition, Wiley India Pvt. Ltd. ISBN 9780471505327.
5. Skoog and West, Fundamentals of Analytical Chemistry, 8th Edition, Thomson Asia. ISBN : 9780495558286.
6. P. S. Kalsi, Spectroscopy of Organic compounds New age international ISBN 81-224-1543-1.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2017 - 2018
SECOND YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Minor Project
	COURSE CODE	CH213
	COURSE CREDITS	2
RELEASED DATE : 01/06/2017	**REVISION NO**	0.0

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

PRE-REQUISITE : ME103: Design Thinking, ET206: Prototyping

COURSE OBJECTIVES :

CH213.CEO.1: Learn to identify and define a problem to be solved.
CH213.CEO.2: Develop design for the solution of the problem using engineering tools available.
CH213.CEO.3: Design working model for the solution of the problem.
CH213.CEO.4: Evaluate the model built for its correctness, reliability and sustainability.

COURSE OUTCOMES :

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

CH213.CO.1: Illustrate how to define the problem to be solved.
CH213.CO.2: Apply knowledge of various engineering tools to develop the solution to the problem.
CH213.CO.3: Analyze various options available to solve the problem and select the appropriate one.
CH213.CO.4: Justify the selection of the method to solve the problem.
CH213.CO.5: Build the working model of the solution to solve the problem.

PREAMBLE:

It is a need of the time to pay attention to the societal needs by an engineering graduate to solve some of the real life societal problems by providing affordable technological solutions. The concept of the minor project follows the same theme. The minor project aims to identify the problems from the society and develop the solutions for the same using science and technology for the betterment of society or human life.

GUIDELINES:

1. Every student shall undertake the Minor Project in semester IV
2. Every student shall work on an approved project, a group of 03 students (maximum) shall be allotted for each minor project
3. The group members could be from different departments to support the interdisciplinary functioning
4. The students have to identify the social problem by through discussion with people, site visits, etc.
5. Once the problem is identified, students have to collect the sufficient data to prove the importance of the problem to be solved
6. By analyzing the collected data, students have to define the actual problem
7. Once the problem is defined, the students have to enumerate various approaches and solutions to solve the problem
8. The students have to select and justify one of the solutions identified based on the feasibility, affordability and ease of use
9. The solution of the selected approached has to be developed using some prototype or model or implementation
10. The three-member committee of jury members will be appointed to monitor the progress and continuous evaluation of each project. One of the members will be the project guide. Assessment of the project for award of grade shall be done jointly by the guide and committee of jury members

TIMELINE:

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

ASSESSMENT:

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

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

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

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

Presentation 5: Final demonstration

MIT | Academy of Engineering

MIT ACADEMY OF ENGINEERING, ALANDI

An Autonomous Institute Affiliated to

Savitribai Phule Pune Univeristy

Curriculum

For

Third Year

Bachelor of Technology in Chemical Engineering

2016-2020

(With Effect from Academic Year: 2018-2019)

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	CURRICULUM STRUCTURE (2016 - 2020)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2018-19
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEEERING	RELEASE DATE	:	1/12/2017
	REVISION NO.	:	0.0

SEMESTER: V

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC5	CH301	Chemical Engineering Thermodynamics	3	2	4
2.	DC6	CH302	Heat Transfer	3	2	4
3.	DC7	CH303	Mass Transfer	3	2	4
4.	OE1	CH31#	Open Elective - Refer Annexure.	3	2	4
5.	HSS4	HP302	Professional Skills	0	4	2
6.	SDP5	CH304	Skill Development Lab	---	4	2
TOTAL				**12**	**16**	**20**

SEMESTER:VI

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC8	CH 321	Separation Process	3	2	4
2.	DC9	CH 322	Chemical Reaction Engineering	3	2	4
3.	DC10	CH 323	Chemical Equipment Design	2	4	4
4.	OE2	CH 33#	Open Elective - Refer Annexure.	3	2	4
5.	HSS5	HP301	Project Management	1	2	2
6.	HSS6	HP303	Basics of Entrepreneurship	---	2	1
7.	SDP6	CH324	Mini Project	---	4	2
TOTAL				**12**	**18**	**21**

L: Lecture, P: Practical

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Chemical Engineering Thermodynamics
	COURSE CODE	CH301
	COURSE CREDITS	4
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

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

PRE-REQUISITE : AS201: Applied Mathematics, CH211: Momentum Transfer

COURSE OBJECTIVES :

CH301.CEO.1: Know the concept of thermodynamics and its applications in chemical engineering.
CH301.CEO.2: Get information about the various thermodynamic properties and their applications.
CH301.CEO.3: Get knowledge about the heat effects and refrigeration cycle and its applications.
CH301.CEO.4: Understand the phase and chemical reaction equilibrium with its applications.
CH301.CEO.5: Learn the various thermodynamic relations.
CH301.CEO.6: Know the real thermodynamic applications.

COURSE OUTCOMES :

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

CH301.CO.1: Define the thermodynamics laws and its applications.
CH301.CO.2: State and determine the thermodynamic properties of system e.g. enthalpy, entropy.
CH301.CO.3: Apply knowledge of thermodynamics in chemical engineering applications.
CH301.CO.4: Formulate and estimate the involvement of thermodynamics in the system.
CH301.CO.5: Implement knowledge of heat and refrigeration effects in day to day applications.
CH301.CO.6: Evaluate chemical reaction equilibrium constant and its use in actual problem.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Thermodynamics and Basic Concepts**	**7 HOURS**
Basic thermodynamics properties; Concept of internal energy; First law of thermodynamics; thermodynamic systems, state & path functions, reversible processes, Duhems Theorem, Enthalpy and Heat capacity; P-V-T behavior of pure substance, Virial Equations of state and its applications, Ideal Gas, Cubic equations of state.		
UNIT 2	**Laws of Thermodynamics and Thermodynamic Properties**	**7 HOURS**
2nd law of thermodynamics, its statement, Heat engines, Concept of Entropy, Entropy change, mathematical statement of 2nd law of thermodynamics, 3rd law of thermodynamics; Property relations, Maxwell equations, residual properties, two phase system, thermodynamic diagram.		
UNIT 3	**Heat Effects and Refrigeration**	**7 HOURS**
Sensible heat effects, temperature dependence of heat capacity, standard heat of reaction, standard heat of formation, standard heat of combustion, temperature dependence of H0, heat effects of industrial reactions. I-C engine, Refrigeration- Carnot and vapor compression, refrigerant, liquefaction, Heat pumps.		
UNIT 4	**Solution Thermodynamics and its applications**	**7 HOURS**
Fundamental property relations, chemical potential, effect of T and P on chemical potential, criteria for phase equilibrium, partial properties, ideal gas mixtures, fugacity and fugacity coefficients for pure species, Poynting factor, for species in solution, ideal solutions; Excess properties, activity coefficients, Margules equation, Van Laar equation. Peng Robinson equation.		
UNIT 5	**Vapor/Liquid and Phase Equilibrium**	**7 HOURS**
The nature of equilibrium, criteria of equilibrium, Raoults law, dew point and bubble point calculations, Flash calculations, Henrys law; Equilibrium and stability, liquid-liquid equilibrium, solid-liquid equilibrium, osmotic equilibrium.		
UNIT 6	**Chemical Reaction Equilibrium and Equilibrium Constant**	**7 HOURS**
The reaction coordinates, Chemical equilibrium, the standard Gibbs free energy change and the equilibrium constant, effect of temperature on equilibrium constant, evaluation of the equilibrium constant; calculation of equilibrium conversion for single reactions.		

PRACTICAL		
PRACTICAL NO.01	**Enthalpy Calculations**	**2 HOURS**
Determination of enthalpy associated with system.		
PRACTICAL NO.02	**Heat Engine**	**2 HOURS**
Working principle of heat engine.		
PRACTICAL NO.03	**Concept of Entropy**	**2 HOURS**
Determination of entropy for a given system.		
PRACTICAL NO.04	**Heat of Reaction**	**2 HOURS**
Determination of heat of given reaction.		
PRACTICAL NO.05	**Refrigeration**	**2 HOURS**
Working principle of refrigerator and determination of COP.		
PRACTICAL NO.06	**Application of Raoults Law**	**2 HOURS**
Application of Raoults Law for given vapor/liquid equilibrium system.		
PRACTICAL NO.07	**Equilibrium Constant**	**2 HOURS**
Determination of equilibrium constant for a given reaction.		
PRACTICAL NO.08	**Equation of State**	**2 HOURS**
Simulation for equation of state using Aspen HYSYS.		
PRACTICAL NO.09	**Fugacity Coefficient**	**2 HOURS**
Simulation for Fugacity coefficients using Aspen HYSYS.		
PRACTICAL NO.10	**Phase Equilibrium**	**2 HOURS**
Simulation for phase equilibrium using Aspen HYSYS.		
PRACTICAL NO.11	**Project**	**4 HOURS**
Project.		

TEXT BOOKS

1. Smith J.M., Van NessHendrick, Abbott Michael M., Introduction to Chemical Engineering Thermodynamics, McGraw-Hill Education, 7th Edition, 2005 ISBN: 0073104450.
2. Narayanan K. V., Chemical Engineering Thermodynamics, PHI Learning Pvt. Ltd., 2nd Edition, 2013. ISBN: 9788120347472.
3. Rao Y.V.C., Chemical Engineering Thermodynamics:, Universities Press, 1st Edition, 2004. ISBN: 817371048.
4. Daubert T. E., Chemical Engineering Thermodynamics, McGraw-Hill, 2nd Edition, 1987 ISBN: 0070154139.

REFERENCE BOOKS

1. Denbigh Kenneth, Principles of Chemical Equilibrium: With Applications in Chemistry and Chemical Engineering, Cambridge University Press, 4th Edition, 1981, ISBN: 0521236827.
2. Glasstone S., Read Books, Thermodynamics for Chemists, 1st Edition, 2007, ISBN: 1406773220.
3. Yunus A. engel and Michael A. Boles, Thermodynamics: An Engineering Approach, McGraw-Hill, 6th Edition, 2007, ISBN: 0071257713.
4. Kalyan Annamalai and Ishwar K. Puri, Advanced Thermodynamics Engineering, CRC Press, 2nd Edition,2011, ISBN: 9781439805725.
5. John M. Prausnitz, Rudiger N. Lichtenthaler, Edmundo Gomes de Azevedo, Molecular Thermodynamic, Prentice Hall Inc, , 3rd Edition, 1999, ISBN:0139777458.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Heat Transfer
	COURSE CODE	CH302
	COURSE CREDITS	4
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

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

PRE-REQUISITE : CH202: Material and Energy balance, CH211: Momentum Transfer

COURSE OBJECTIVES :

CH302.CEO.1: To learn the different modes of heat transfer and the concept of conductive heat transfer.

CH302.CEO.2: To understand the concept of convection and overall combined heat transfer coefficient for conduction-convection in process heat exchangers.

CH302.CEO.3: To learn heat transfer involving phase changes such as condensation and boiling.

CH302.CEO.4: To study concept of radiation energy and the radiation between surfaces including various theories related to heat radiation.

CH302.CEO.5: To study various heat exchange equipment used in process industry.

CH302.CEO.6: To 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,

CH302.CO.1: Identify the different modes of heat transfer and use the conduction calculations for various geometries.

CH302.CO.2: Apply the principles of convection for thermal systems.

CH302.CO.3: Implement the concepts of heat transfer with phase changes.

CH302.CO.4: Analyze the systems involving radiation and to solve problems pertaining to them.

CH302.CO.5: Analyze different types of heat exchangers based on fundamental concepts.

CH302.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, Fourier's 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.		
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.		
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.		
UNIT 5	**Heat Exchangers**	**7 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 Wilson's plot, design of various types of heat exchangers, design of furnaces, design of condensers, design of tubular reactors		
UNIT 6	**Heat transfer in Agitated vessels**	**7 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.		

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 shell and tube heat exchanger for cocurrent 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 BOOK

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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Mass Transfer
	COURSE CODE	CH303
	COURSE CREDITS	4
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

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

PRE-REQUISITE : CH211: Momentum Transfer

COURSE OBJECTIVES :

CH303.CEO.1: Understand the concept and use of separation processes.
CH303.CEO.2: Learn the basics of diffusion and the empirical laws that govern diffusion.
CH303.CEO.3: Understand the analogies between momentum, mass and heat transfer.
CH303.CEO.4: Understand the concept and importance of mass transfer coefficient.
CH303.CEO.5: Understand the mechanism of all simultaneous heat and mass transfer operations.
CH303.CEO.6: Understand the uses and design concept of separation processes.

COURSE OUTCOMES :

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

CH303.CO.1: Calculate the molar flux for different systems.
CH303.CO.2: Determine the individual and overall transfer coefficients.
CH303.CO.3: Use the Psychrometric chart for humidification operations.
CH303.CO.4: Analyze the drying rate of the given material.
CH303.CO.5: Develop the equilibrium data for crystallization operation.
CH303.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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Process Modeling and Simulation
	COURSE CODE	CH311
	COURSE CREDITS	4
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

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

PRE-REQUISITE : CH301: Chemical Engineering Thermodynamics, CH303: Mass Transfer

COURSE OBJECTIVES :

CH311.CEO.1: Know the types of models and its applications.
CH311.CEO.2: Understand the steps involved in building mathematical model.
CH311.CEO.3: Understand the selection of models for various chemical process.
CH311.CEO.4: Learn the development of mathematical model for various operations.
CH311.CEO.5: Know the development process of mathematical models for reaction systems.
CH311.CEO.6: Know and use of various simulation softwares.

COURSE OUTCOMES :

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

CH311.CO.1: Construct mathematical model and exercise model building procedure for steady and unsteady processes.
CH311.CO.2: Formulate material, energy and momentum balancing for chemical processes.
CH311.CO.3: Develop mathematical model for heat and mass transfer processes and simulate it.
CH311.CO.4: Formulate model for chemical reactors.
CH311.CO.5: Apply developed mathematical model for a given system.
CH311.CO.6: Carry out simulation by using simulation software packages viz Aspen HYSYS, etc.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Modeling and Simulation**	**7 HOURS**
Definition of model, types of models, formation & applications of mathematical model, definition of simulation and its applications, Scope of the modeling and simulation in process industries, fundamental laws: continuity equation, energy equation, equation of motion, transport equation, equation of state, phase and chemical equilibrium, chemical kinetics.		
UNIT 2	**Models in Fluid Flow Operations**	**7 HOURS**
The continuity equation, Flow through Packed bed column, Laminar Flow in narrow Slit, Flow of Film on the outside of circular tube, Momentum fluxes for creeping flow in to slot.		
UNIT 3	**Modeling of Process Equipment**	**7 HOURS**
Agitated vessels, pressure change equipment, mixing process, fluid solid operations, storage tanks, two heated tanks, Heat exchangers, evaporators.		
UNIT 4	**Modeling of Mass Transfer Equipment.**	**7 HOURS**
Flash distillation, differential distillation, and continuous binary distillation in tray and packed column, vaporizers, single phase and multiphase separation, multi-component separation, drying equipment, adsorption, absorbers and strippers.		
UNIT 5	**Modeling of Reaction Equipment**	**7 HOURS**
Examples of mathematical models of chemical engineering systems, batch reactor, constant volume CSTRS, gas phase pressurized CSTR, non-isothermal CSTR.		
UNIT 6	**Applications of Modeling and Simulation**	**7 HOURS**
Transient analysis of staged absorbers, unsteady state analysis in reactor system, Modeling and simulation of effluent treatment plant, Use of numerical methods to solve different models, introduction to Different simulation software.		

PRACTICAL		
PRACTICAL NO.01	**Continuous Stirred Tank Reactor (CSTR)**	**2 HOURS**
Simulation of CSTR using MATLAB for isothermal reaction.		
PRACTICAL NO.02	**Agitated Tank**	**2 HOURS**
Simulation of agitated vessel using MATLAB.		
PRACTICAL NO.03	**Shell and Tube Heat Exchanger**	**2 HOURS**
Simulation of shell and tube heat exchanger using MATLAB.		
PRACTICAL NO.04	**Plug Flow Reactor**	**2 HOURS**
Simulation of plug flow reactor using Aspen HYSYS.		
PRACTICAL NO.05	**Distillation Column**	**2 HOURS**
Simulation of distillation column using Aspen HYSYS.		
PRACTICAL NO.06	**Packed Absorption Column**	**2 HOURS**
Simulation of packed absorption column using Aspen HYSYS.		
PRACTICAL NO.07	**Extraction**	**2 HOURS**
Simulation of extraction column using Aspen HYSYS.		
PRACTICAL NO.08	**Process Flow Diagram**	**2 HOURS**
Steady state simulation of process flow diagram using Aspen HYSYS.		
PRACTICAL NO.09	**Process Flow Diagram**	**2 HOURS**
Steady state simulation of process plant using Aspen HYSYS.		
PRACTICAL NO.10	**Dynamic Simulation**	**2 HOURS**
Introduction to dynamic simulation using Aspen HYSYS.		
PRACTICAL NO.11	**Project**	**4 HOURS**
Project.		

TEXT BOOKS

1. Luyben W. L., Process Modeling Simulation and Control for Chemical Engineers, McGraw Hill, 2nd ed.1988, ISBN: 0070391599, 9780070391598.
2. Davis M. E., Numerical Methods and Modeling for Chemical Engineers, Wiley, New York, 1984, ISBN: 0486782328, 9780486782324.
3. Finlayson B. A., Nonlinear analysis in Chemical Engineering, McGraw Hill, New York, 2003, ISBN: 096317651X, 9780963176516.
4. Chapra S.C., R.P. Canale, Numerical Methods for Engineers, Tata-McGraw Hill Publications, 5th Ed, 2005, ISBN: 0073101567, 9780073101569.
5. Himmelblau D., K.B. Bischoff, Process Analysis and Simulation, John Wiley& Sons, 1968, ISBN: 0471399906, 978-0471399902.

REFERENCE BOOKS

1. Franks R.E.G., Modeling and Simulation in Chemical Engineering, Wiley Interscience, NY, 1972, ISBN: 9780471275350.
2. John Ingam, Irving J. Dunn., Chemical Engineering Dynamic Modeling with PC simulation, VCH Publishers, ISBN: 9783527297764.
3. Kayode Coker A., Chemical Process Design, Analysis and Simulation, Gulf Publishing Company, 1995 ISBN: 008050678X, 9780080506784.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Professional SKills
	COURSE CODE	HP302
	COURSE CREDITS	2
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

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 : HP101: Language and Comminucation 1,
HP102: Language and Communication 2

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

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

PRACTICALS: (SECTION A)		
PRACTICAL NO.01	**Self Awareness**	**2 HOURS**
Concept of Johari Window, Advantages and disadvantages of every quadrant, Identifying the proportion of each quadrant in respect of self, Using the tools of 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 BOOK

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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Skill Development Lab 1
	COURSE CODE	CH304
	COURSE CREDITS	2
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

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 :

COURSE OBJECTIVES :

CH304.CEO.1: Understand the basis of chemical engineering softwares such as Aspen HYSYS.
CH304.CEO.2: Learn the application of simulation software for solution of engineering problems.
CH304.CEO.3: Make aware about the chemical engineering concepts in efficient problem solving.
CH304.CEO.4: Construct a bridge between manual calculation and computer simulation.
CH304.CEO.5: Develop an ability to effectively use computational techniques to solve chemical engineering problems.
CH304.CEO.6: Learn the design aspects of chemical process plant.

COURSE OUTCOMES :

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

CH304.CO.1: Identify the operation/process required to solve an engineering problem.
CH304.CO.2: Match manual calculation with computer simulation.
CH304.CO.3: Apply the knowledge of chemical engineering basics to computational techniques.
CH304.CO.4: Categorize different types of equipments based upon application.
CH304.CO.5: Assess complex chemical engineering problems.
CH304.CO.6: Design 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	**Reactor Simulation**	**4 HOURS**
CSTR Simulation.		
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**	**10 HOURS**
Glycol dehydration process(utilization and application in industry), practical example based on project already executed by industry faculty.		
PRACTICAL NO.09	**Separators**	**4 HOURS**
Dynamic analysis of separators (Applications of Controllers and control system). This will mainly focus on level and flow control for the separators.		
PRACTICAL NO.10	**Project**	**12 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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Separation Process
	COURSE CODE	CH321
	COURSE CREDITS	4
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

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

PRE-REQUISITE : CH303: Mass Transfer

COURSE OBJECTIVES :

CH321.CEO.1: Understand the concept of vapor-liquid equilibrium and distillation.
CH321.CEO.2: Learn the various separation processes used in chemical industry.
CH321.CEO.3: Understand the equilibrium data and its application in the design.
CH321.CEO.4: Understand the mechanism of absorption, extraction, leaching & adsorption.
CH321.CEO.5: Introduce advanced separation techniques.
CH321.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,

CH321.CO.1: Generate the vapor - liquid equilibrium data for the given system.
CH321.CO.2: Perform material balance for batch and continuous distillation.
CH321.CO.3: Calculate the mass transfer coefficient for the different system.
CH321.CO.4: Analyze the effectiveness of the given separation column.
CH321.CO.5: Perform material balance calculations for different types of extraction units.
CH321.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.**	**4 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	**Composition Vs Refractive Index**	**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.		
PRACTICAL NO.04	**Vapour Liquid Equilibria**	**2 HOURS**
Estimation of VLE for given system (Methanol Water).		
PRACTICAL NO.05	**Wetted Wall Column**	**2 HOURS**
Estimation of mass transfer coefficient in wetted wall column for air water system.		
PRACTICAL NO.06	**Packed Bed Absorption**	**2 HOURS**
Estimation of mass transfer coefficient for packed bed gas absorber.		
PRACTICAL NO.07	**Simple Leaching**	**2 HOURS**
Estimation of separation efficiency for single / multi stage leaching.		
PRACTICAL NO.08	**Counter Current Leaching**	**2 HOURS**
Counter current leaching in 3 stages for the given system.		
PRACTICAL NO.09	**Liquid Liquid Equilibria**	**2 HOURS**
Liquid - Liquid Equilibrium for the given system.		
PRACTICAL NO.10	**Plait Point**	**2 HOURS**
Identification of plait point for the given system.		
PRACTICAL NO.11	**Batch Adsorption**	**2 HOURS**
Batch adsorption studies and identification of Langmuir isotherm constants.		
PRACTICAL NO.12	**Ion Exchange**	**2 HOURS**
Studies on Ion Exchange unit.		

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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Chemical Reaction Engineering
	COURSE CODE	CH322
	COURSE CREDITS	4
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

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

PRE-REQUISITE : CH301: Chemical Engineering Thermodynamics, CH303: Mass Transfer

COURSE OBJECTIVES :

CH322.CEO.1: To learn about reaction kinetics for different types of reactions.
CH322.CEO.2: To solve problems involving mass and energy balance with reaction.
CH322.CEO.3: To design chemical reactors such as batch reactor, mixed reactor and plug flow reactor.
CH322.CEO.4: To determine reaction mechanism using experimental data.
CH322.CEO.5: To develop critical and creative thinking skills related to reaction engineering.

COURSE OUTCOMES :

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

CH322.CO.1: Identify different reaction types and mechanisms.
CH322.CO.2: Explain the various types of reactors and their applications.
CH322.CO.3: Apply rate equations to determine the kinetic parameters of a reaction.
CH322.CO.4: Compare the behavior of different reaction order systems.
CH322.CO.5: Analyze the data obtained for different reactor systems.
CH322.CO.6: Design a reactor based on the reaction kinetic data.

THEORY COURSE CONTENT		
UNIT 1	**Batch Reactor Data Analysis**	**8 HOURS**
Constant volume & variable volume reactor, fractional conversion, unimolecular & multi-molecular reactions, integral & differential methods of analysis, half-life & fractional life methods, reactions in series & parallel, autocatalytic reactions, homogenous catalyzed reactions, reactions of shifting order.		
UNIT 2	**Reactor Design for Single Reactions**	**8 HOURS**
Ideal batch reactor, steady state mixed flow reactor, steady state plug flow reactor, performance equation, holding time, space time & space velocity, single reactors, size comparison of reactors, mixed flow vs. plug flow, multiple reactor systems, plug flow reactors in series and/or in parallel, equal size mixed flow reactors in series, mixed flow reactors of different sizes in series, reactors of different types in series, recycle reactor, reactor combinations for autocatalytic reactions.		
UNIT 3	**Reactor Design for Multiple Reactions**	**8 HOURS**
Qualitative and quantitative discussion for multiple reactions, contacting patterns for reactions in parallel, selectivity, irreversible reactions of same or different orders in series, reversible reactions in series and parallel, two step irreversible series-parallel reactions, instantaneous and overall fractional yield, product distribution and temperature.		
UNIT 4	**Non-Ideal Flow**	**8 HOURS**
Residence Time Distribution(RTD), state of aggregation, earliness & lateness of mixing, relation between F & E curves, conversion in non-ideal flow reactors, self mixing of a single fluid and mixing of two miscible fluids, compartment models, dispersion model, tanks in series model, convection model for laminar flow, segregated flow model.		
UNIT 5	**Solid Catalyzed Reactions**	**8 HOURS**
Surface chemistry and adsorption, factors affecting rate of reaction, rate equation for surface kinetics, pore diffusion resistance, Thiele modulus, effectiveness factor, rate controlling mechanism, heat effects during reaction, performance equations for reactors containing porous catalysts, product distribution in multiple reactions, staged adiabatic packed bed reactor, single packed bed reactor and two packed bed reactors in series, trickle bed reactor, multiple reactions and product distribution in fluidized beds, three phase fluidized bed reactor, reaction rate and performance equations, reactor design.		
UNIT 6	**Non-Catalytic Systems**	**8 HOURS**
Rate equation for mass transfer with reaction, kinetic regimes, film conversion parameter, Hatta number, application to design (fast and slow reactions), contactor selection, performance equations for different contactors, progressive conversion model (PCM), shrinking core model (SCM), spherical particles of changing and unchanging sizes, determination of rate controlling step, various contacting patterns in fluid-solid reactors, application to design.		

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	**Isothermal CSTR**	**2 HOURS**
To study the kinetics of a reaction at isothermal conditions using CSTR.		
PRACTICAL NO.04	**Plug Flow Reactor (PFR)**	**2 HOURS**
To study the kinetics of a reaction at ambient conditions using PFR.		
PRACTICAL NO.05	**Combined Flow Reactor**	**2 HOURS**
To study the kinetics of a reaction using a CSTR followed by PFR.		
PRACTICAL NO.06	**Cascade CSTR**	**2 HOURS**
To study the kinetics of a reaction using three CSTRs in series.		
PRACTICAL NO.07	**Non-ideal Flow in CSTR**	**2 HOURS**
To study the residence time distribution in CSTR.		
PRACTICAL NO.08	**Non-ideal Flow in PFR**	**2 HOURS**
To study the residence time distribution in PFR.		
PRACTICAL NO.09	**Recycle Reactor**	**2 HOURS**
To study the kinetics of a reaction using a recycle reactor.		
PRACTICAL NO.10	**Project**	**6 HOURS**
Project.		

TEXT BOOKS

1. O. Levenspiel, Chemical Reaction Engineering, 3rd edition, John Willey & sons, 1998, ISBN: 9788126510009.
2. J M Smith, Chemical Engineering Kinetics, 3rd edition, McGraw-Hill Inc., 1990, ISBN: 9780070665743.

REFERENCE BOOKS

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Chemical Equipment Design
	COURSE CODE	CH323
	COURSE CREDITS	4
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
2	4	30	40	30	25	50	175

PRE-REQUISITE : CH203: Chemical Engineering Operations, ME201: Material Engineering

COURSE OBJECTIVES :

CH323.CEO.1: Give comprehensive knowledge of various process equipment used in the chemical industries.
CH323.CEO.2: Provide knowledge about design principles of pressure vessels used in chemical plants.
CH323.CEO.3: Impart knowledge about standards and codes used in design.
CH323.CEO.4: Impart the knowledge of various design aspects and specifications used for process equipment.
CH323.CEO.5: Understand and calculate various design parameters for process equipment.
CH323.CEO.6: Understand the knowledge of mechanical design of various process equipment.

COURSE OUTCOMES :

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

CH323.CO.1: Understand the basics of process equipment design and important parameters of equipment design.
CH323.CO.2: Design different types of pressure vessels.
CH323.CO.3: Have complete knowledge of equipment fabrication and testing methods.
CH323.CO.4: Use various codes and standards used for equipment design.
CH323.CO.5: Find out the suitable material of construction, fabrication methods for various process equipment.
CH323.CO.6: Apply their knowledge for designing of process equipment.

THEORY COURSE CONTENT		
UNIT 1	**Basic Considerations in Design**	**8 HOURS**
Simple stresses and strains, concept of stress, strain, shear stress, shear strain, Hooks law, elastic limit and stress-strain curve for mild steel and elastomeric materials, Poissons ratio and factor of safety, Youngs modulus, strain energy due to axial load and impact, material behavior under stresses, theories of failures, corrosion allowance, weld joint Shear force and bending moment, deflection in beams, bending stress, torsional shear stress, stresses in struts, stresses in flat plates.		
UNIT 2	**Pressure Vessel, Flanges and Nozzles**	**8 HOURS**
Selection of type of vessels, design considerations, optimum length to diameter ratio of pressure vessel using common types of closures, introduction to codes for pressure vessel design and classification of pressure vessels as per codes, design of cylindrical and spherical shells under internal and external pressure, design of jacketed portion of vessels, design of high pressure monoblock and multilayer vessels. Flanges: Selection of gaskets, selection of standard flanges, optimum selection of bolts for flanges, design of flanges. Nozzles: Nozzle types, classification and arrangements, nozzle reinforcements and performance loss in nozzles.		
UNIT 3	**Reaction Vessel**	**8 HOURS**
Agitator: Study of various types of agitators, their selection, applications, baffling, power systems which includes twisting moment, equivalent bending moment, design of blades. Reaction vessel: Introduction, classification, design of vessel, heating systems, 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 and plain jackets, design of CSTR, Design of shell for all tower used at high wind and seismic conditions. Supports: Design of lug, skirt and saddle support including bearing plates and anchor bolts.		
UNIT 4	**Heat Exchanger**	**8 HOURS**
Process design of shell and tube heat exchanger: Types of heat exchanger, genera design considerations - LMTD correction factor, fluid allocation, fluid velocities, stream temperatures, pressure drop, shell side and tube side heat transfer coefficients, overall heat transfer coefficient. 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, design of double pipe heat exchanger, condenser, reboiler.		
UNIT 5	**Auxiliary Equipment, Evaporator & Dryer**	**8 HOURS**
General design considerations of various liquid- liquid, gas-liquid separators, cyclone separators, centrifuges and other separation equipment. Design evaporator: Introduction, types of evaporator, general design consideration of evaporator. Design of dryer: Introduction, type of dryer, design consideration of dryer.		

UNIT 6	Process Design of Mass Transfer Column	8 HOURS
Design of distillation and absorption column: Design variables in distillation, design methods for binary systems, plate efficiency, approximate column sizing, plate contactors, and plate hydraulic design. 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.		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Drawing of different heads and closures for pressure vessels.		
PRACTICAL NO.02		**2 HOURS**
Design and drawing of cylindrical and spherical shell.		
PRACTICAL NO.03		**2 HOURS**
Design and drawing of tall towers.		
PRACTICAL NO.04		**2 HOURS**
Design and drawing of jackets and vessels (with AutoCAD).		
PRACTICAL NO.05		**2 HOURS**
Design and drawing of gaskets and flanges (with AutoCAD).		
PRACTICAL NO.06		**2 HOURS**
Drawing of different types of supports (with AutoCAD).		
PRACTICAL NO.07		**2 HOURS**
Design and drawing of double pipe heat exchanger (with AutoCAD).		
PRACTICAL NO.08		**2 HOURS**
Design and drawing of Shell and tube heat exchanger (with AutoCAD).		
PRACTICAL NO.09		**2 HOURS**
Design and drawing Evaporator (with AutoCAD).		
PRACTICAL NO.10		**2 HOURS**
Design and drawing Decanter (with AutoCAD).		

PRACTICAL NO.11		2 HOURS
Drawing of Internal coil reaction vessel assembly (with AutoCAD).		
PRACTICAL NO.12		**2 HOURS**
Drawing of agitated reaction vessel assembly (with AutoCAD).		

TEXT BOOKS

1. Brownell L.E. and Young H.E, "Process 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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Process Engineering
	COURSE CODE	CH331
	COURSE CREDITS	4
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

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

PRE-REQUISITE : CH311: Process Modeling and Simulation

COURSE OBJECTIVES :

CH331.CEO.1: Learn the fundamentals of process engineering and understand the role of process engineer.
CH331.CEO.2: Know the basis of PFD and P&ID diagrams.
CH331.CEO.3: Learn the development of PFD and P&ID of process.
CH331.CEO.4: Understand the selection and sizing of equipment.
CH331.CEO.5: Learn the selection of equipment as per requirement.
CH331.CEO.6: Understand the design procedure of process equipment.

COURSE OUTCOMES :

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

CH331.CO.1: Identify the role of process engineer.
CH331.CO.2: Construct PFD and P&ID with material and energy balance calculations.
CH331.CO.3: Design and size the equipment as per requirement in process industries.
CH331.CO.4: Interpret the process equipment data.
CH331.CO.5: Evaluate sizing of equipment.
CH331.CO.6: Select proper process equipment as per given requirement.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Process Engineering**	**7 HOURS**
Overview of process industry and role of Process Engineer, Responsibilities of Process Engineer/Designer, Introduction to Process, Basic design requirement based on the type of plant / project, Scope of Process- Inputs and Outputs. Basic engineering activities, Basic engineering package (BEP), Front end engineering design (FEED), Relevant Standards/Codes, their importance and applications, Design basis, Major phases in the life cycle of chemical process plant- Technical and Economic Feasibility of General & Specific project.		
UNIT 2	**PFD and P&ID of Equipments**	**7 HOURS**
Relevant Codes and Standards used in industry; Symbols for P&ID, PFD and P&ID for process equipments, Development of PFD: Process & Utility,; Development and preparation P&ID, Mass and Energy balance - Design Basis, Sample Calculations, Development of P&ID : Process and Utility. Material selection, MSD (Material selection Diagram), DPDT Diagram (Design Pressure, Design Temperature Diagram), pipeline sizing.		
UNIT 3	**Selection of Equipments**	**7 HOURS**
Preparation of fluid list, line list, equipment list, utility consumption summery, catalyst and chemicals summery, effluent summery, selection of rotary equipment pumps, compressors, blowers, fans, Valves, reactors, heat exchangers, etc; process data sheets.		
UNIT 4	**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 5	**Heat Exchanger Design**	**7 HOURS**
Shell and tube heat exchanger, general design method for shell and tube heat exchanger, Criteria of selection between horizontal and vertical condenser, Process Design of reboiler and vaporizer, Plate heat exchangers.		
UNIT 6	**Process Design of Distillation Column**	**7 HOURS**
Criteria of selection, selection of equipment for distillation, Distillation column design, batch Distillation, short path distillation, Reactive distillation.		

PRACTICAL		
PRACTICAL NO.01	**Process Flow Diagram**	**2 HOURS**
Development of PFD for 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	**Safety Valve**	**2 HOURS**
Sizing of safety valve.		
PRACTICAL NO.05	**Reactor Sizing**	**2 HOURS**
Determine the sizing of reactor.		
PRACTICAL NO.06	**Centrifugal Pump**	**2 HOURS**
Design of centrifugal pump for a given capacity..		
PRACTICAL NO.07	**Shell and Tube Heat Exchanger**	**2 HOURS**
Design of shell & Tube heat exchanger.		
PRACTICAL NO.08	**Distillation Column**	**2 HOURS**
Design of distillation column.		
PRACTICAL NO.09	**Project**	**2 HOURS**
Project.		

TEXT BOOKS

1. Thakore & Bhatt, Introduction to Process Engineering and Design, Tata McGraw-Hill Education, 2007, ISBN: 0070634157, 9780070634152.
2. Stanley M. Walas, Chemical Process Equipment - Selection and Design, Butterworth-Heinemann, 1988, ISBN: 0750693851, 9780750693851.

REFERENCE BOOKS

1. Harry Silla, Chemical Process Engineering Design and Economics, CRC Press, 2003,ISBN: 0824756444, 9780824756444.
2. Henry Kister, Distillation Operation, McGraw Hill Professional, 1990, ISBN: 007034910X, 9780070349100.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Project Management
	COURSE CODE	HP301
	COURSE CREDITS	2
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

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

PRE-REQUISITE : NIL

COURSE OBJECTIVES :

HP301.CEO.1: To introduce the basic concept and scope of Project Management.
HP301.CEO.2: To teach the theory of project Initiation and its analysis with project vision.
HP301.CEO.3: To introduce the concept of risk analysis and different types of tools used in project planning.
HP301.CEO.4: To guide learners monitoring and controlling project progress.
HP301.CEO.5: To introduce the concept of System dynamics, project audit and reviews.

COURSE OUTCOMES :

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

HP301.CO.1: Explain the concept of project management.
HP301.CO.2: Develop an ability to analyze scope, objective and vision of project initiation.
HP301.CO.3: Able to analyze risk and different tools of project planning.
HP301.CO.4: Develop an ability to measure progress of project by monitoring and controlling
HP301.CO.5: Identify the problems associated with project and reviewing the same.

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

PRACTICALS		
PRACTICAL NO.01	**SDLC**	**2 HOURS**
Preparing for managing and developing a perfect model of SDLC for a particular given problem.		
PRACTICAL NO.02	**PERT and CPM**	**2 HOURS**
Planning a project under PERT and CPM charts		
PRACTICAL NO.03	**GERT and SLAM**	**2 HOURS**
Planning a project under GERT and SLAM charts		
PRACTICAL NO.04	**DPM**	**2 HOURS**
Solving practical problems under DPM		
PRACTICAL NO.05	**Variance Limit**	**2 HOURS**
Project monitoring under variance and controlling according to the given situations.		

PRACTICAL NO.06	System Dynamics	2 HOURS
Understanding System dynamics by solving case studies		
PRACTICAL NO.07	**Change Management**	**2 HOURS**
Solving case studies for learning how change management works.		
PRACTICAL NO.08	**Project Reviewing**	**2 HOURS**
Solving many practical problems by reviewing projects as well as some case studies.		

TEXT BOOK

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

REFERENCE BOOK

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

MIT Academy of Engineering (An Autonomous Institute Affillated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Basics of Entrepreneurship
	COURSE CODE	HP303
	COURSE CREDITS	1
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

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

PRE-REQUISITE : Wadhwani Foundation Orientation Course

COURSE OBJECTIVES :

HP303.CEO.1: To understand the fit between you and your entrepreneurialambitions
HP303.CEO.2: To find a problem worthsolving
HP303.CEO.3: To identify yourcustomers
HP303.CEO.4: To develop a solution for your customers' problems and problemsolution
HP303.CEO.5: To build and demonstrate anMVP
HP303.CEO.6: To structure a business model around the problem, customer, and solution and present your Business ModelCanvas.

COURSE OUTCOMES :

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

HP303.CO.1: Why entrepreneurship requires
HP303.CO.2: Outline the Problems Worth Solving by using various techniques like DT, JTBD
HP303.CO.3: Identify the Customer Segments and Early Adopters
HP303.CO.4: Develop the solution demo for identify problem.
HP303.CO.5: Create Business Model Canvas and Minimum Viable Product

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

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

REFERENCES

1. Read Forbes article and do Group Discussionhttps://www.forbes.com/sites/chrismyers/2015/12/16/find-your-flow-and-success-will-follow/
2. https://necrophone.com/2014/01/20/effectuation-the-best-theory-of-entrepreneurship-you-actually-follow-whether-youve-heard-of-it-or-not/
3. Use your self awareness to find out what motivates and drives Entrepreneurial activity - Ted Talk "What is your Entrepreneurial style - EntrepreneurKnow
4. Prof. Clay Christensen "IdentifyingCustomerNeeds" https://www.youtube.com/watch?v=yVCZ-7xSsCw
5. Understand the customer problem by GOOTB":by GOOTB":https://www.youtube.com/watch?v=sEENIZgscDw
6. https://www.forbes.com/sites/danschawbel/2013/12/17/geoffrey-moore-why-crossing-the-chasm-is-still-relevant
7. Value Proposition: https://www.youtube.com/watch?v=jZN6CUieuOQ&list=PLw540Wq5kay866m6A6xI7KOwEAh7is4m
8. Value Proposition & Customer Need:https://www.youtube.com/watch?v=6FnG8pJL8yM&index=3&list=PLw540Wq5kay866m6A6xI7KOwEAh7is4m
9. https://strategyn.com/turn-customer-input-into-innovation/ CASE STUDIES in ODI: https://jobs-to- be-done.com/tagged/case-study
10. TheLeanBMC https://www.youtube.com/watch?v=FjBe7UO1hc
11. Ash Maurya -Capture your BMC in 20
12. minuteshttps://www.youtube.com/watch?v=7o8uYdUaFR4&t=462s
13. Ash Maurya - How to Prioritize Risks on Your BusinessModel https://www.youtube.com/watch?v=01z7EPXS42k
14. https://pt.slideshare.net/bmorelean/dan-lemberg-lean-pitch
15. https://startups.fb.com/en-in/categories/development/
16. Designing Experiments: https://www.youtube.com/watch?v=WiMZWCg1Hu8&t=111s
17. Customer Development Process:https://www.youtube.com/watch?v=lLEebbiYIkI
18. Beating the Competition: https://www.youtube.com/watch?v=46uP6vOj5G0
19. Q&A with Garr :https://www.youtube.com/watch?v=SmJjjOrusyI
20. Basic Accounting Lingo for Entrepreneurs:https://www.youtube.com/watch?v=Y7Pm1jEEKE
21. Vinod Khosla : How Leaders can BUILDhttps://www.youtube.com/watch?v=bRCoBgCn1Q
22. Vinod Khosla: https://www.youtube.com/watch?v=VIrNLzTs9cw
23. How to Pitch the way VC's think, so you can convince co-founders : https://www.youtube.com/watch?v=fTgU7THoKCw
24. Tony Buzan:http://www.tonybuzan.com/about/mind-mapping/
25. Google : Think branding:https://www.youtube.com/watch?v=1l2CUjkg0ug
26. The Battle for your mind using Positioning:https://www.youtube.com/watch?v=jQrY8xRx-0 Design rules-https://www.igorinternational.com/, Web design course:https://www.coursera.org/specializations/web-designStrikingly Free : https://www.strikingly.com/online-resume/linkedin
27. https://certification.hubspot.com/inbound-sales-certification-course
28. https://www.udemy.com/courses/business/sales/
29. https://www.accountingtools.com/articles/2017/5/17/sales-budget-sales-budget-example

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2018 - 2019
THIRD YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Mini Project
	COURSE CODE	CH324
	COURSE CREDITS	2
RELEASED DATE : 01/12/2017	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
NIL	4	NIL	NIL	20	NIL	55	75

PRE-REQUISITE : ET206: Prototyping, CH213: Minor project

COURSE OBJECTIVES :

CH324.CEO.1: Understand the Product Development Cycle through Mini project.

CH324.CEO.2: Undertake & execute a mini Project through a group of students.

CH324.CEO.3: Inculcate skills in engineering product design and development process, budgeting, planning, testing, effective trouble-shooting practices, aesthetics and ergonomics.

CH324.CEO.4: Understand the role of professional and ethical practices, management principles, technical documentation and communication skills in engineering.

COURSE OUTCOMES :

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

CH324.CO.1: Execute an idea in a team as well as within constraints.

CH324.CO.2: Acquire knowledge of the techniques, skills and modern engineering tools necessary for engineering practices.

CH324.CO.3: Use standard engineering tools and processes for design, simulation, testing, analysis in implementation and deployment of theoretical idea into practice.

CH324.CO.4: Use standard documentation and presentation tools for a professional report and presentation of the work.

PREAMBLE:
It is a need of the time to pay attention to the societal needs by an engineering graduate to solve some of the real life societal problems by providing affordable technological solutions. The concept of the minor project follows the same theme. The minor project aims to identify the problems from the society and develop the solutions for the same using science and technology for the betterment of society or human life.

PRACTICAL

Stage- 1	**Formation of group and Allocation of project adviser**	**Week-1**

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

Stage- 2	**Project Review -1 Internal review by project adviser**	**Week-2&3**

1. The project group will work on,
a. Conceptualization of an Idea.
b. Literature review.
c. Market survey.
d. Finalizing the Specifications.
2. Presentation of work progress to project adviser and proceed to project approval.

Stage- 3	**Project Review -2 Project Approval**	**Week-4**

1. Presentation of concept to Department Review Committee (DRC) or Committee appointed by department.
2. Review of concept and feasibility of project and necessary suggestions for implementation by the committee.
3. The project group will make corrections and continue their work.

Stage-4	**Project Review -3 Internal review by project adviser**	**Week- 5to9**

1. The project group will work on, a. System Architecture and Design, b. Simulation /software development (As applicable), c. Manufacturing of project, d. Assembly, e. Testing, f. Troubleshooting.
2. Presentation of work progress to project adviser and proceed to final project progress review.

Stage-5	Project Review -4 Final Project progress review	Week-10&11

1. The project group will work on, a. Result analysis against specifications, b.Enclosure/Aesthetic design (As applicable), c.Technical report generation (Draft copy), d. Users manual (As applicable), e. Bill of material etc.
2. The technical report may incorporate following points:
Title, Introduction and Concept, Literature & Market survey, Theory and relevance, Block diagram, Drawings (As applicable), Specifications, Project plan, Bill of material, Enclosure/aesthetic design (As applicable), Results, Results analysis, Conclusion, References.
3. Presentation of project work, draft copy of technical report, Final presentation etc. to DRC or Committee appointed by department.
4. Review of project progress and necessary suggestions by DRC or Committee appointed by department for final presentation.
5. The project group will make corrections. After clearing all comments from DRC; project can be presented to final l examination.
6. Project must be approved by department to appear for final examination.

Stage-6	Examination: Final Demonstration and presentation	Week-12

1. Final examination will be divided in three parts: a) Demonstration, b) Presentation, c) Project documentation.
2. For final examination project must be demonstrated in front of examiner panel. For Industry sponsored projects or other installations examiner panel can visit the project venue.
3. All students must be physically present in front of examiner panel at the time of examination.
4. Only demonstrated projects can be evaluated for presentation and documentation.
5. Mini Project demonstration: Demo of project works and validation of project results to examiners panel.
6. Mini Project presentation: Presentation of overall project work form project idea to implementation and deployment of project to examiners panel.
7. Mini Project documentation: Presentation of technical documentary report to examiners panel.

Assessment:

1. Internal Assessment:
a. Project Review -2 Project Approval -05 Marks
b. Project Review -3 Internal review by project adviser- -05 Marks
c. Project Review -4 Final Project progress review- 10 Marks
2. Examination: Final Demonstration and presentation:
a. Mini Project demonstration: 20 Marks
b. Mini Project presentation: 20 Marks
c. Mini Project documentation: 15 Marks

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Curriculum

For

Final Year

Bachelor of Technology in Chemical Engineering

2016-2020

(With Effect from Academic Year: 2019-2020)

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	CURRICULUM STRUCTURE (2016 - 2020)		
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	:	2019-20 (PART A)
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEEERING	RELEASE DATE	:	1/12/2018
	REVISION NO.	:	0.0

SEMESTER: VII

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC11	CH401	Process Dynamics, Control & Instrumentation	3	2	4
2.	DE1	CH41#	Dept. Elective - Refer Annexure.	3	0	3
3.	OE3	CH42#	Open Elective - Refer Annexure.	3	2	4
4.	HSS7	HP402	Sociology	2	---	2
5.	HSS8/ SDP7	HP403/ CH402	Business Strategies / Skill Development Lab 2	---	2	1
6.	SDP8	CH403	Project - I	---	8	4
7.	SDP9	CH404	Summer Internship	---	---	4
TOTAL				**11**	**14**	**22**

SEMESTER: VIII

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC12	CH431	Chemical Process Technology	3	2	4
2.	DE2	CH44#	Dept. Elective - Refer Annexure.	3	0	3
3.	OE4	CH45#	Open Elective - Refer Annexure.	3	2	4
4.	HSS9	HP401	Engineering Economics	2	---	2
5.	SDP10	CH432	Project - II	---	8	4
TOTAL				**11**	**12**	**17**

L: Lecture, P: Practical

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Process Dynamics and Control
	COURSE CODE	CH401
	COURSE CREDITS	4
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

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

PRE-REQUISITE : CH302 Heat Transfer, CH321 Separation Processes

COURSE OBJECTIVES :

CH401.CEO.1: Make aware of dynamics of different systems.
CH401.CEO.2: Learn about the use of computer application in control system design.
CH401.CEO.3: Solve the Bode Plot diagrams.
CH401.CEO.4: Understanding of the system stability criterion.
CH401.CEO.5: Learn the Feedback control system dynamic.
CH401.CEO.6: Understand the plant wide control system.

COURSE OUTCOMES :

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

CH401.CO.1: Experiment transfer functions of different systems and their response required for stability analysis.
CH401.CO.2: Categorize controller tuning for stable systems in chemical process plants.
CH401.CO.3: Correlate multiple loops and use the computers in process control in chemical process industries.
CH401.CO.4: Compare stable & unstable systems by Bode Stability criterion.
CH401.CO.5: Evaluate control system for various process operations.
CH401.CO.6: Apply various softwares used for control systems.

THEORY COURSE CONTENT		
UNIT 1	**Dynamic behavior of Simple processes**	**7 HOURS**
Characteristics of Chemical Process Control, Mathematical modeling of a chemical process, State variables and state equation, Input-Output model, Linearization of nonlinear systems, 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	**Design of single-loop feedback control systems**	**7 HOURS**
Second order system Damped vibrator, 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 behaviour of feed-back control processes.		
UNIT 3	**Stability Analysis of feed-back 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**
Time constant of thermocouple second order system.		
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**
Temperature control study.		

TEXT BOOKS

1. Stephanopoulos George Chemical Process Control, PHI publication, ISBN: 9789332549463.
2. Coughanour Donald R. Process System Analysis & Control, Mc Graw Hill, ISBN: 9780073397894.

REFERENCE BOOKS

1. Bequette B. Wayne Process Control Modeling, Design & Simulation, PHI Publication, Hardcover, ISBN: 9780133536409.
2. Mellichamp Dancan A., Edgar Thomal F., Seborg Dale E Process Dynamics & Control, ISBN: 9780471863892.
3. Ray W. Harmon, Ogunnaike Babatunde A., Process Dynamics, Modeling & Control, Oxford University Press Inc. ISBN: 978019591199.
4. Chindambaram M. Computer Control of Processes, Alpha Science International Ltd. ISBN: 9781842650639.
5. Liptak Bella G. Instrument Engineers Handbook (Process Control), Elsevier, ISBN: 9780801972904.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Introduction to Paint Technology
	COURSE CODE	CH411
	COURSE CREDITS	3
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

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

PRE-REQUISITE :

COURSE OBJECTIVES :

CH411.CEO.1: Understand Global and Indian scenario for paint manufacturing industries with production methods and capacity.

CH411.CEO.2: Recognize different film formation technique and role of chemical engineer in industry.

CH411.CEO.3: Identify and understand various standards followed in Paints industry.

CH411.CEO.4: Evaluate current testing methods with importance of optimization. Analyze importance of raw material quality and specification on processing of material.

CH411.CEO.5: Understand selection of process and various parameters used for process selection with major engineering problem.

CH411.CEO.6: Know safety practices & pollution control norms in paint industries.

COURSE OUTCOMES :

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

CH411.CO.1: Interpret growth and market trends in paint manufacturing industries.

CH411.CO.2: Apply knowledge of film formation and proper use of it to avoid defects.

CH411.CO.3: Evaluate methods compared with standard methods.

CH411.CO.4: Problem solving skills and decision making skills needed for working with an industry.

CH411.CO.5: Evaluate effect of raw material quality on product processing and quality

CH411.CO.6: Understand problem solving and decision making skills needed for working with an industry. Develop as team player and follow safety practices.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Paint**	**7 HOURS**
Introduction to Surface Coatings, classification, definition of paints, varnishes, lacquer, pigment, extender. General composition of surface coatings, function of pigments, extenders, binders, driers, additives in surface coatings. History of developments of surface coatings, Global scenario and past, present and future of Indian Coating Industry.		
UNIT 2	**Film Formation**	**7 HOURS**
Fundamental of film formation. Chemical Composition, functionality and degree polymerization and film properties. Concept of functionality. Types of coatings, convertible and non convertible.		
UNIT 3	**Natural surface coatings**	**7 HOURS**
Vegetable and marine Oils for surface coatings. Classification of oils, fats and waxes. Non drying, drying and semidrying oils. Sources and composition. Methods of extraction and refining of drying oils from vegetable and marine origin.		
UNIT 4	**Polymerization**	**7 HOURS**
Polymerisation of drying oils, thermal and oxidative. Formation of stand, blown and boiled oils. Limed oils, Treated Oils. Dehydrated oils, DCO, Copolymerized oils, film formation and deterioration.		
UNIT 5	**Dries**	**7 HOURS**
Dries, mechanism of drying action. Composition of dries, drier metals, drier absorption. Analysis of metal content. Preliminary analysis of Paints, Indian Standards specifications for paints.		
UNIT 6	**Plant layout and Safety**	**7 HOURS**
Factory lay out: Principles, general considerations, typical flow diagrams, single & multi storied buildings, different sections of a paint factory and their locations, Instrumentation and automation. Safety considerations in storage of hazardous and inflammable raw materials. Fire Protection and safety: Sources, types, Fire & explosion index, safety measures for protection.		

TEXT BOOKS

1. W Billmeyer, Text Book of Polymer Science, Interscience Publishers Inc, New York 1962, ISBN 10: 0471072966 / ISBN: 9780471072966.
2. A.S. Khanna, Paints and Varnishes, Indian Central Iolsee Committee, 1959, ISBN: 978817409167.
3. H F Payne, Organic Coating Technology, Vol I, John Wiley and Sons, New York, ISBN: 9780471672869.
4. Rodger Talbert, Paint technology handbook, CRC Press, ISBN: 9781574447033.

REFERENCE BOOKS

1. Paint Technology Manual: Vol I, II Oil and Colour Chemists Association, ISBN: 8978133310847.
2. T P Hilditch, The Chemical Constitution of Natural Fats, 2nd Edition, John Wiley and Sons, 1947 SBN 10: 0412022508 ISBN: 9780412022500
3. J J Matellio, Protective and Decorative Coatings, Vol I, John Wiley and Sons, ISBN: 9780471958185.
4. Surface Coatings: Vol I, Raw Materials and their useage, Oil and Colour Chemists Association, Australia ISBN: 9789401169400.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Energy Engineering
	COURSE CODE	CH412
	COURSE CREDITS	3
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	30	40	30	NIL	25	125

PRE-REQUISITE : CH301: Chemical Engineering Thermodynamics, CH302: Heat Transfer

COURSE OBJECTIVES :

CH412.CEO.1: Know the conventional and renewable energy sources.
CH412.CEO.2: Understand the various ways to harness energy.
CH412.CEO.3: Understand the energy conservation and conversion techniques.
CH412.CEO.4: Develop the insight to use proper energy techniques tools.

COURSE OUTCOMES :

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

CH412.CO.1: Classify the conventional and renewable energy sources.
CH412.CO.2: State the various applications of each form of energy.
CH412.CO.3: Make appropriate use of the energy conversion tools.
CH412.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.		

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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Petroleum Refining Technology
	COURSE CODE	CH413
	COURSE CREDITS	3
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	30	40	30	NIL	25	125

PRE-REQUISITE : CH321: Separation Process

COURSE OBJECTIVES :

CH413.CEO.1: Explain the market drivers for the refining industry.
CH413.CEO.2: Understand composition and characteristics of crude oils.
CH413.CEO.3: Understand various test for petroleum products.
CH413.CEO.4: Classify the processes used in petroleum refining.
CH413.CEO.5: Sketch a flow diagram that integrates all refining processes and the resulting refinery products.
CH413.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,

CH413.CO.1: Interpret the petroleum refinery flow diagram and its major challenges.
CH413.CO.2: Analyze the importance of pre refining operation.
CH413.CO.3: Understand Specification and test methods for fuel.
CH413.CO.4: Understand Hydrogen and Sulphur production Flowsheet.
CH413.CO.5: Interpret processes used in refinery with its importance.
CH413.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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Biochemical Engineering
	COURSE CODE	CH414
	COURSE CREDITS	3
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

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

PRE-REQUISITE : CH322: Chemical Reaction Engineering

COURSE OBJECTIVES :

CH414.CEO.1: Provide basic knowledge of biochemical engineering.
CH414.CEO.2: Understand the kinetics of enzymes.
CH414.CEO.3: Learn techniques and industrial applications of enzymes.
CH414.CEO.4: Get concept of metabolic study.
CH414.CEO.5: Study Cell Kinetics study and design of fermentor.
CH414.CEO.6: Learn concept of sterilization.

COURSE OUTCOMES :

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

CH414.CO.1: Discuss basics of Biology and Overview of Biotechnology.
CH414.CO.2: Develop cell and enzyme kinetics.
CH414.CO.3: Illustrate methods of immobilization.
CH414.CO.4: Analysis and Stability of Bioreactors.
CH414.CO.5: Apply sterilization methods.
CH414.CO.6: Reframe bio-product Recovery & Bio-separations, Manufacture of Biochemical Products.

THEORY COURSE CONTENT		
UNIT 1	**Introduction**	**7 HOURS**
Basics of Biology; Overview of Biotechnology; Diversity in Microbial Cells, Cell Constituents, Chemicals for Life.		
UNIT 2	**Fermentation**	**7 HOURS**
Fermentation, types of mechanisms, continuous fermentation, aeration and agitation, kinetics of fermentation processes.		
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	**Study of 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. J. E. Bailey & D. F. Ollis, Biochemical Engineering Fundamentals , 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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Environmental Engineering
	COURSE CODE	CH415
	COURSE CREDITS	3
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

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

PRE-REQUISITE : CH201: Environmental Science, CH212: Advanced Chemistry

COURSE OBJECTIVES :

CH415.CEO.1: Acquire knowledge about the importance of environment and environmental standards.
CH415.CEO.2: Ability to work & learn effectively on environmental issues such as air pollution.
CH415.CEO.3: To develop skills of design of control devices for air pollution.
CH415.CEO.4: The ability to apply quantitative reasoning skills to environmental problems including basic calculations related to water quality parameters.
CH415.CEO.5: Ability to work effectively on complex problem of waste water treatment.
CH415.CEO.6: To describe the impact of solid waste on land.

COURSE OUTCOMES :

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

CH415.CO.1: Understand the importance of environment and environmental standards.
CH415.CO.2: Identify the sources of Air pollution & suggest the steps to mitigate air pollution.
CH415.CO.3: Specify control devices for air pollution.
CH415.CO.4: Calculate BOD / COD for a given composition of effluent stream.
CH415.CO.5: Identify tools and techniques for tertiary waste water treatment.
CH415.CO.6: Predict the different strategies for solid waste management.

THEORY COURSE CONTENT		
UNIT 1	**Introduction**	**6 HOURS**
Definition, scope and importance of environment, an overview of environmental engineering, environmental impact of thermal, hydro and nuclear energy, Introduction to all prevailing international standards of Environment; Environmental laws and regulations; Standards (air quality, noise, water).		
UNIT 2	**Air Pollution**	**6 HOURS**
Air pollutants: sources (specific pollutants), effects, and dispersion modelling, air pollution, air quality, pollutants minimisation and control, Economic effects of air pollution, sampling and measurement of air pollutants, air pollution control standards: WHO, BIS, MPCB, CPCB role of an individual in prevention of pollution air pollution case studies.		
UNIT 3	**Air Pollution Control Methods and Equipment**	**6 HOURS**
Particulate pollution: cleaning methods, collection efficiency, particulate collection systems, Basic design and operating principles of settling chamber, cyclone separator, fabric filter, electrostatic precipitator, Principles of control by absorption, adsorption, combustion or catalytic oxidation, removal of SOx, NOx.		
UNIT 4	**Water Pollution and Wastewater Treatment**	**6 HOURS**
Groundwater and surface water pollution, Waste water characteristicsDO, BOD, COD, TOC, total suspended solids, colour and odour, bacteriological quality, oxygen deficit, determination of COD, BOD, Water quality standards: ICMR, WHO, MPCB and CPCB, removal of specific water contaminants; 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**
Sources and classification of solid wastes, disposal methods, incineration, composting, recovery and recycling.		

TEXT BOOKS

1. Gilbert M.Masters, Introduction to Environmental Engineering and Science, 3rd edition, Pearson Education (2004), ISBN:9780131481930.
2. R. W. Gaikwad and R. S. Sapkal, Environmental Engineering, Denett & Co, ISBN: 9788190322836.
3. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill, New Delhi, (2006).2nd edition, ISBN: 9780070648135).

REFERENCE BOOKS

1. Rao C. S. Environmental Pollution Control Engineering, Wiley Eastern Publications, ISBN: 0470217634.
2. Metcalf and Eddy Wastewater Engineering, Tata McGraw Hill Publishers, ISBN10: 0070418780.
3. G. Kiely, Environmental Engineering, McGraw Hill 1997, ISBN: 9780071164245.
4. Rajagopalan, R, Environmental Studies-From Crisis to Cure, Oxford University Press, Third Edition, ISBN: 9780199459759.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Process Synthesis, Design and Optimization
	COURSE CODE	CH421
	COURSE CREDITS	4
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

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

PRE-REQUISITE : CH331: Process Engineering

COURSE OBJECTIVES :

CH421.CEO.1: Learn basic concepts of process design.
CH421.CEO.2: Study the fundamental of process synthesis.
CH421.CEO.3: Study the process optimization and development.
CH421.CEO.4: Study reactor synthesis and reaction network in process industries.
CH421.CEO.5: Learn project cost estimation calculations.
CH421.CEO.6: Learn economic viability of project.

COURSE OUTCOMES :

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

CH421.CO.1: Apply concepts of process design on given problem.
CH421.CO.2: Apply process synthesis approach.
CH421.CO.3: Optimize the process with given constraints.
CH421.CO.4: Synthesize the reactor with given process requirements.
CH421.CO.5: Estimate project cost.
CH421.CO.6: Do economic feasibility study of process plant.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Process Optimization and Process Design**	**9 HOURS**
Optimization introduction, features of optimization problems, general procedure for solving. Optimization problems, obstacles to optimization, fitting functions to empirical data. The method of least squares, formulation of various process optimization problems. Identification of chemical products & processes to solve societal problems / meet market demands, Characteristics of basic / industrial / consumer products. Process Design team, Steps in product & process design, process engineering Software tools and their applications.		
UNIT 2	**Constituents & Construction of Process Simulation**	**7 HOURS**
Difference between process flow sheet and simulation flow sheet, Formulation of unit processes and operations, selection of feasible operating conditions and appropriate thermodynamic models, Degrees of freedom, Design specifications, Analysis, validation & applications of simulation outputs.		
UNIT 3	**Process Synthesis & Development**	**7 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, fluid moving machinery, Reactor heating & cooling systems, Heat exchangers & fired heaters, Solids size reduction and separations.		
UNIT 4	**Synthesis Reactor Design & Reaction Network**	**8 HOURS**
Reaction models / types of reactors, reaction stoichiometry, Reaction equilibrium, Reaction kinetics, Complex reactor design, Reactor network design for attainable region. Selection & design of separation trains: Feed separation system, Phase separation of reactor effluent, Industrial separation operations, Criteria for selection of separation methods, Selection of separation equipment, Separation system for gas mixture and Separation sequence for solid fluid system.		
UNIT 5	**Reactor-Separator Recycle Network**	**5 HOURS**
Location of separation section, Optimization between reaction and separation sections, Optimization of reactor conversion, Reaction to extinction, Snowball effect with respect to recycle.		
UNIT 6	**Project Cost Estimation and Economic Viability Study**	**7 HOURS**
Typical capital project cost component, Typical operating cost components, Classes of cost estimates, Cost estimation by applying factors, Detailed cost estimation method, Financial viability calculation (Payback period, Breakeven point, IRR and Net present value).		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Design of process plant.		
PRACTICAL NO.02		**2 HOURS**
Optimization of process design.		
PRACTICAL NO.03		**2 HOURS**
Construction of process simulation.		
PRACTICAL NO.04		**2 HOURS**
Synthesis of chemical process plant: Case study-1.		
PRACTICAL NO.05		**2 HOURS**
Synthesis of chemical process plant: Case study-2.		
PRACTICAL NO.06		**2 HOURS**
Reactor network design for attainable region.		
PRACTICAL NO.07		**2 HOURS**
Reactor conversion optimization.		
PRACTICAL NO.08		**2 HOURS**
Project cost estimation.		
PRACTICAL NO.09		**2 HOURS**
Economic viability study.		

TEXT BOOKS

1. Dale F. Rudd, Gary J. Powers, Jeffrey J. Siirola, Process Synthesis, Prentice-Hall, 1973, ISBN: 0137233531, 9780137233533.
2. E. L. Cussler, Edward Lansing Cussler, G. D. Moggridge, Chemical Product Design, Cambridge University Press, 2001, ISBN: 0521796334, 9780521796330.
3. Thokozani Majozi, Esmael Reshid Seid, Jui-Yuan Lee, Synthesis, Design, and Resource Optimization in Batch Chemical Plants, CRC Press, 2015, ISBN: 9781482252422.
4. Max Stone Peters, Klaus D. Timmerhaus, Ronald Emmett West, Plant Design and Economics for Chemical Engineers, 5th Edition, McGraw-Hill, 2003, ISBN: 0071240446, 9780071240444.

REFERENCE BOOKS

1. 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.
2. John Happel, Donald G. Jordan, Chemical process economics Volume 1 of Chemical processing and engineering, 2nd Edition, M. Dekker, 1975, ISBN: 0824761553, 9780824761554.

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

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

PRE-REQUISITE :

COURSE OBJECTIVES :

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

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

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

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

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

COURSE OUTCOMES :

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

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

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

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

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

THEORY

UNIT 1	Introduction to Sociology	6 HOURS

The nature of Sociology, meaning of Sociology: Origin, Definition, Scope, Culture, meaning, components, beliefs, values, norms, technology, diversity, towards a global culture.

UNIT 2	Sociolization	5 HOURS

Socialization, Agents of Socialization, Heredity and Environment, Group, Social structure, Status and role, family, school, peer group, media, adult socialization, resocialization, Role of Social moments, Illustrations: Women, Tribal & Dalit Movements .

Further Reading:

UNIT 3	Nature and factors of Social Change	5 HOURS

Change: Meaning. Nature and factors of Social Change: Biological Factors. Demographic Factors, Technological Factors, Economic Factors Cultural Factors, Info-tech factors, Meaning of Gender sensitization, Discrimination, violence and Abuse.

Further Reading:

UNIT 4	Visions of Social Change in India	4 HOURS

Idea of development planning and mixed economy, Constitution, law and social change, Education and social change.

Further Reading:

UNIT 5	Works and Economic Life	4 HOURS

Social organization of work in different types of society- slave society, feudal society, industrial /capitalist society. Formal and informal organization of work. Labour and society.

Further Reading:

UNIT 6	Introduction to Applied sociology	4 HOURS

The use of Sociology: Introduction to applied Sociology-Sociology and social problems, Ecology and Environment: Pollution, Global warming and Greenhouse effect. Impact of Industrialization and Urbanization on Environment.

REFERENCE BOOKS

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Skill Development Lab 2
	COURSE CODE	CH402
	COURSE CREDITS	1
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

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

PRE-REQUISITE :

COURSE OBJECTIVES :

CH402.CEO.1: Understand the basis of chemical engineering softwares such as Aspen HYSYS.
CH402.CEO.2: Learn the application of simulation software for solution of engineering problems.
CH402.CEO.3: Make aware about the chemical engineering concepts in efficient problem solving.
CH402.CEO.4: Construct a bridge between manual calculation and computer simulation.
CH402.CEO.5: Develop an ability to effectively use computational techniques to solve chemical engineering problems.
CH402.CEO.6: Learn the design aspects of chemical process plant.

COURSE OUTCOMES :

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

CH402.CO.1: Identify the operation/process required to solve an engineering problem.
CH402.CO.2: Match manual calculation with computer simulation.
CH402.CO.3: Apply the knowledge of chemical engineering basics to computational techniques.
CH402.CO.4: Categorize different types of equipments based upon application.
CH402.CO.5: Assess complex chemical engineering problems.
CH402.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	**Flash Drum**	**2 HOURS**
Stepwise Aspen Simulation of Flash Drum.		
PRACTICAL NO.04	**Aspen Simulation of Reactor Model**	**2 HOURS**
Aspen simulaion of CSTR Model.		
PRACTICAL NO.05	**Aspen Simulation of Distillation Model**	**2 HOURS**
Aspen Simulation of DSTWU Model.		
PRACTICAL NO.06	**Absorption Column**	**2 HOURS**
Aspen Simulation and Analysis of Absorption Column.		
PRACTICAL NO.07	**Reactive Distillation**	**2 HOURS**
Aspen Sumulation of Reactive Distillation Column.		
PRACTICAL NO.08	**Binary Distilation Column**	**2 HOURS**
Dynamics and Control of Binary Distillation Column.		
PRACTICAL NO.09	**Evaporator**	**2 HOURS**
Aspen Simulation of Evaporator.		
PRACTICAL NO.10	**Project**	**12 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 SYLLABI (2016 – 2020)	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Business Strategies
	COURSE CODE	HP403
	COURSE CREDITS	1
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

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

PRE-REQUISITE : HP303 : Basics of Entrepreneurship

COURSE OBJECTIVES :

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

COURSE OUTCOMES :

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

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

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

REFERENCE BOOKS

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Major Project-I
	COURSE CODE	CH403
	COURSE CREDITS	4
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

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

PRE-REQUISITE : CH324: Mini Project

COURSE OBJECTIVES :

CH403.CEO.1: Implement the idea/ real time industrial problem/ current application from engineering domain.

CH403.CEO.2: Evaluate an alternative approaches and justify the use of selected tools and methods.

CH403.CEO.3: Inculcate skills in engineering product design and development process, budgeting, Planning, testing, effective trouble-shooting practices.

CH403.CEO.4: Understand the roles and responsibility, accountability and learn team work ethics.

COURSE OUTCOMES :

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

CH403.CO.1: Solve real life problems by applying the knowledge and problem solving ability.

CH403.CO.2: Analyze alternative approaches, find feasible solution and apply most appropriate one.

CH403.CO.3: Use standard engineering tools and processes for analysis, design, simulation, testing, Implementation and deployment of idea into practice.

CH403.CO.4: Participate effectively in multidisciplinary and heterogeneous teams exhibiting team work, inter-personal Relationship, conflict management and leadership quality.

PREAMBLE:

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

GUIDELINES:

Project work stage I is an integral part of Project work. In this, the student shall complete the partial work of project, consist of problem statement, literature survey, Project specification and planning. The students expected to complete the project at least up to the design phase. As a part of project phase-I, candidate shall appear for two reviews and delivered the presentation on the advancement of selected project topic. The student shall submit the duly certified project report in standard format for satisfactory completion of work by the concern Advisor and Dean of the School. The examinee will be assessed by panel of examiner of which one is necessarily as a external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question answer and report. Preparation of the Literature survey paper and communicating and publishing in relevant publishing agency agency is recommended. Bonus 10 marks will be awarded. Follow the guideline and formats as mentioned in guideline document Annexure-I.

TIMELINE:

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

ASSESSMENT:

1. Internal Assessment (TW)

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

2. Examination: Final Demonstration and presentation

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

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Chemical Process Technology
	COURSE CODE	CH431
	COURSE CREDITS	4
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

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

PRE-REQUISITE : CH203: Chemical Engineering Operation

COURSE OBJECTIVES :

CH431.CEO.1: Understand standard equipment symbols, process control and instrumentation symbols used for flow sheeting and types of flow diagram.

CH431.CEO.2: Recognize different industry, their products and role of chemical engineer in industry.

CH431.CEO.3: Identify and understand manufacturing of various chemicals and sequence of operations and their importance.

CH431.CEO.4: Evaluate current material and energy demand with importance of optimization. Analyze importance of raw material quality and specification on processing of material.

CH431.CEO.5: Understand selection of process and various parameters used for process selection with major engineering problem.

CH431.CEO.6: Know safety practices & pollution control norms in chemical industries. Necessary of moral and ethical value needed.

COURSE OUTCOMES :

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

CH431.CO.1: Interpret manufacturing Flowsheet and visualized actual size and shape of equipments.
CH431.CO.2: Categorized chemical industry and understand specification of different raw material and its importance.
CH431.CO.3: Select proper process from available process and evaluate effect of operating parameter on quality.
CH431.CO.4: Problem solving skills and decision making skills needed for working with an industry.
CH431.CO.5: Understand the importance of ecology & energy crisis.
CH431.CO.6: Develop as team player and follow safety practices.

THEORY COURSE CONTENT

UNIT 1	**Basic Concepts of Process Industries**	**8 HOURS**

A. Theory of Unit operations and industrial equipment and systems used in large scale plants; Unit processes, Development of flow 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**	**8 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 industry**	**8 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; steam-reforming process technology.
B. Coal gasification technologies (Fixed bed (Lurgi Process) Fluidised bed (Winkler Process).

UNIT 4	**Phosphorus and Paper Pulp Industry**	**8 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 Industry	8 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. Membrane cell, mercury cell diaphragm cell processes and electrolytic cell processes and flowsheets.		
UNIT 6	**Cement and Steel Industry**	**8 HOURS**
A. Importance of Cement and Lime and Production of Cement by rock beneficiation process and Portland cement. Importance of Lime and Manufacturing of lime. B. Blast Furnace construction details and Uses. Manufacturing of Iron and steel.		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Preparation of Methyl Esters of Fatty Acids from Soybean Oil (Bio-Diesel) using Unit Process Esterification.		
PRACTICAL NO.02		**2 HOURS**
Preparation of Oxalic Acid from Cane Sugar using Unit Process Oxidation.		
PRACTICAL NO.03		**2 HOURS**
Preparation of Urea Formaldehyde Resin using Unit Process Polymerisation.		
PRACTICAL NO.04		**2 HOURS**
Preparation of Phenol Formaldehyde Resin (PF Resin) using Acid Catalyst using Unit Process Polymerisation.		
PRACTICAL NO.05		**2 HOURS**
Preparation of P-bromo Acetanilide from Acetanilide using Unit Process Halogenation.		
PRACTICAL NO.06		**4 HOURS**
Preparation of m-Dinitrobenzene from Nitrobenzene using Unit Process Nitration.		
PRACTICAL NO.07		**2 HOURS**
Preparation of Acetanilide from Crude Aniline using Unit Process Acetylation.		
PRACTICAL NO.08		**2 HOURS**
Preparation of Pthalamide from Pthalic Anhydride using Unit Process Amination By Ammonolysis.		
PRACTICAL NO.09		**2 HOURS**
Preparation of Nerolin from -Napthol using Unit Process Alkylation.		

PRACTICAL NO.10		**2 HOURS**
Drawing at least two Auto CAD sheets for manufacturing of Urea, Ethanol, Phenol.		
PRACTICAL NO.11		**2 HOURS**
Drawing Unit operation symbols.		
PRACTICAL NO.12		**2 HOURS**
Introduction to Simulation software for chemical engineering.		
PRACTICAL NO.13		**2 HOURS**
Material and Energy balance calculation for any of to process.		

TEXT BOOKS

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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Paint Manufacturing Process
	COURSE CODE	CH441
	COURSE CREDITS	3
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	30	40	30	NIL	25	125

PRE-REQUISITE : CH411: Introduction to Paint Technology

COURSE OBJECTIVES :

CH441.CEO.1: Understand different types of unit operations used in paint industries.

CH441.CEO.2: Recognize different equipments with its construction and working and role of chemical engineer in industry.

CH441.CEO.3: Identify and understand manufacturing of various paints and role of each ingredients and their importance.

CH441.CEO.4: Evaluate current testing methods with importance of optimization. Analyze importance of raw material quality and specification on processing of material.

CH441.CEO.5: Understand different surface preparation methods with its importance.

CH441.CEO.6: Select appropriate methods for application of paint on surface.

COURSE OUTCOMES :

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

CH441.CO.1: Apply correct unit operation for production of various paints.

CH441.CO.2: Apply knowledge of equipments working for improvement in efficiency for paint industry.

CH441.CO.3: Select proper additives and ingredients for process.

CH441.CO.4: Problem solving skills and decision making skills needed for working with an industry.

CH441.CO.5: Evaluate selection methods for cleaning.

CH441.CO.6: Compare various application methods and choose appropriate methods for application.

THEORY COURSE CONTENT		
UNIT 1	**Process for Manufacturing**	**7 HOURS**
Paint manufacture, steps in manufacture, mixing, grinding and letting down, tinting, straining, filling. Types of coatings, primers, top coats, corrosion resistant finishes, clear finishes.		
UNIT 2	**Equipments used in Process**	**7 HOURS**
Types of machinery required for various steps and their working, construction, designing and function of various parts. Details of machinery for Mixing, edge runners, paint mills (single, twin, three and four roll mills), Ball and pebble mills, sand grinders, attritors, kadymillk, high speed impellers, Filling and labeling machines.		
UNIT 3	**Varnish Manufacture**	**7 HOURS**
Varnish manufacture Oleoresinous varnishes, constituents of varnishes and their function, film properties of varnishes, Types of furnaces and their design, types of kettles and their advantages and disadvantages, design of resin kettle, thinning and cooling tanks, storage of raw materials and finished products, filling and labeling machines.		
UNIT 4	**Testing and Defects**	**7 HOURS**
Coating/printing inks/varnish industry plant layout, flow of material and finishing schedule, sampling of coatings for testing, recording, costing of coatings, Paint Film Defects, their causes and remedies.		
UNIT 5	**Surface Preparation**	**7 HOURS**
Surface preparation for coating, solvent vipeoff, vapour degreasing, alkali cleaning, chemical cleaning, burn off and flame cleaning, mechanical cleaning with hand and power tools, sand blasting, phosphate treatment, treatments for Aluminum and Magnesium.		
UNIT 6	**Application Methods**	**7 HOURS**
Application of coat/paint, brush and roller coating, spray painting (ordinary, Electrostatic, power, airless, two component, hot spray), dipping, flow coating, fluidized bed coating, pressure curtain coating, knife and roller coating, tumbling barrel, silk screen coating, centrifugal coating, design of spray booths.		

TEXT BOOKS

1. Durrans, T.H., Solvents D. Van Nostrand Co., New York, 1950.
2. A.S. Khanna, Paints and Varnishes, Indian Central Iolsee Committee, 1959.
3. H F Payne, Organic Coating Technology, Vol I, John Wiley and Sons, New York.
4. Tank, G. F., Industrial Paint Finishing Techniques and Processes, Ellis Horwood Ltd., 1991.

REFERENCE BOOKS

1. Paint Technology Manual: Vol I, II Oil and Colour Chemists Association.
2. T P Hilditch, The Chemical Constitution of Natural Fats, 2nd Edition, John Wiley and Sons, 1947.
3. J J Matellio, Protective and Decorative Coatings, Vol I, John Wiley and Sons.
4. Surface Coatings: Vol I, Raw Materials and their useage, Oil and Colour Chemists Association, Australia.
5. Bigos Joseph, Steel Structure Painting Mannual, Vol. I and Vol. II, Steel Structures Painting Council, Pittsburg, USA, 1955.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Energy Management and Audit
	COURSE CODE	CH442
	COURSE CREDITS	3
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	30	40	30	NIL	25	125

PRE-REQUISITE : CH412: Energy Engineering

COURSE OBJECTIVES :

CH442.CEO.1: Learn to conserve energy through planning and management.
CH442.CEO.2: Understand Energy Audit procedure along with relevant technologies/tools.
CH442.CEO.3: Develop Energy Audit Report writing skills.
CH442.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,

CH442.CO.1: State the need for energy management and audit.
CH442.CO.2: Execute proper energy management and planning.
CH442.CO.3: Carry out the cost- benefit analysis of various investment alternatives for meeting the energy needs.
CH442.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.		
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.		

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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Petrochemical Technology
	COURSE CODE	CH443
	COURSE CREDITS	3
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/ PRACTICAL	PRESENTATION/ DEMONSTRATION	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA			
3	NIL	30	40	30	NIL	25	125

PRE-REQUISITE : CH413: Petroleum Refining Technology

COURSE OBJECTIVES :

CH443.CEO.1: Apply knowledge of petroleum refining operation and process to obtain various raw materials.
CH443.CEO.2: Understand various unit operations and processes used in Petrochemical industry.
CH443.CEO.3: Identify and understand manufacturing of various petrochemicals.
CH443.CEO.4: Apply proper unit operation for desired separation.
CH443.CEO.5: Understand importance of raw material quality on product specification.
CH443.CEO.6: Understand the safety considerations in Petrochemical industry.

COURSE OUTCOMES :

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

CH443.CO.1: Understand Indian and world scenario for production and demand for Petrochemical.
CH443.CO.2: Understand specification of different raw material and its importance.
CH443.CO.3: Select proper unit operation and processes in synthesis of various Petrochemicals.
CH443.CO.4: Interpret the petrochemical Flowsheet and its major engineering problems.
CH443.CO.5: Select proper process from available process.
CH443.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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Bioprocess Technology
	COURSE CODE	CH444
	COURSE CREDITS	3
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	30	40	30	NIL	25	125

PRE-REQUISITE : CH414: Biochemical Engineering

COURSE OBJECTIVES :

CH444.CEO.1: Provide the basics Of bioreactor engineering.
CH444.CEO.2: Develop bioengineering Skills For The production of biochemical product using integrated biochemical processes.
CH444.CEO.3: Understand engineering principles to address issues in bioprocessing.
CH444.CEO.4: Learn mechanism for enzymatic reaction.
CH444.CEO.5: Estimate kinetics parameters from raw fermentation data.
CH444.CEO.6: Identify limiting factors in downstream processing.

COURSE OUTCOMES :

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

CH444.CO.1: Identify role of bioprocess engineering.
CH444.CO.2: Select Appropriate Bioreactor Configurations and Operation Modes Based upon the Nature of Bio products And Cell Lines And Other Process Criteria.
CH444.CO.3: Apply knowledge on the growth of microorganisms, enzyme kinetics and mass transport in order to create a preliminary design for a bioreactor.
CH444.CO.4: Compare which unit operations are required before and after a bioreactor.
CH444.CO.5: Select an appropriate process path and draw a process diagram, e.g. Block Flow Diagram (BFD) and Process Flow Diagram (PFD) for bioprocesses.
CH444.CO.6: Analyze kinetics of cell growth.

THEORY COURSE CONTENT		
UNIT 1	**Basic Principle of Biochemical Engineering**	**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.		
UNIT 4	**Design of Enzyme Reactors**	**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 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.
3. Brown TA, Genomes, 3rd Edition. Garland Science 2006, ISBN: 9780815345244.
4. Campbell AM & Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings 2007, ISBN: 9780805382198.
5. Primrose S & Twyman R, Principles of Gene Manipulation and Genomics, 7th Edition, Blackwell, 2006, ISBN: 9781405135443.

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.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	W.E.F	AY: 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	COURSE NAME	Chemical Process Safety
	COURSE CODE	CH445
	COURSE CREDITS	3
RELEASED DATE : 01/06/2019	REVISION NO	0.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			TUTORIAL/	PRESENTATION/	TOTAL
LECTURE	PRACTICAL	MSE	ESE	IA	PRACTICAL	DEMONSTRATION	
3	NIL	30	40	30	NIL	25	125

PRE-REQUISITE : CH331: Process Engineering

COURSE OBJECTIVES :

CH445.CEO.1: Know various process utilities.
CH445.CEO.2: Understand about safety aspects in industry.
CH445.CEO.3: Understand the importance of loss of prevention.
CH445.CEO.4: Understand about hazard analysis and toxicology.
CH445.CEO.5: Learn about storage and handling of hazardous chemicals.
CH445.CEO.6: Learn about risk and hazard analysis.

COURSE OUTCOMES :

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

CH445.CO.1: Apply the basic principles of safety.
CH445.CO.2: Develop the roots for hazard analysis.
CH445.CO.3: Identify the event tree and fault tree analysis.
CH445.CO.4: Analyze the hazards in a given process and assess them to provide solutions for operating safely.
CH445.CO.5: Knowledge to choose the safety requirements for storage and handling of a given chemical.
CH445.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. 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, 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.		
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. 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.		

PROJECT		6 HOURS

Project based on

1. Actual case study
2. Working model
3. 3D-Model

Project possibly related to solution for minimizing the accidents in industry, also running the chemical process in a safer way.

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 SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Process Intensification and Integration
	COURSE CODE	CH451
	COURSE CREDITS	4
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

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

PRE-REQUISITE : CH421: Process Synthesis, Design and Optimization

COURSE OBJECTIVES :

CH451.CEO.1: Study process integration.
CH451.CEO.2: Learn different techniques of process integration.
CH451.CEO.3: Understand the process integration approach.
CH451.CEO.4: Study heat and power integration.
CH451.CEO.5: Study process design and control.
CH451.CEO.6: Learn concepts of process intensification and its techniques.

COURSE OUTCOMES :

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

CH451.CO.1: Understand process integration and intensification.
CH451.CO.2: Use different methods of process integration.
CH451.CO.3: Apply process integration approach to given process.
CH451.CO.4: Identify bottlenecks in process for minimization of energy requirements.
CH451.CO.5: Design optimal process route.
CH451.CO.6: Apply process integration and intensification knowledge to different process industry.

THEORY COURSE CONTENT		
UNIT 1	**Introduction to Process Integration**	**6 HOURS**
Process Systems Engineering, Process Integration, Various aspects of process integration, methods of process integration, A brief history of the development of Process Integration.		
UNIT 2	**Process Integration & Techniques**	**7 HOURS**
Overall Mass targeting, Graphical techniques for direct recycle strategies, Synthesis of mass exchange networks, Visualization techniques.		
UNIT 3	**Process Integration Approach**	**8 HOURS**
Targeting direct recycle, Algebraic approach to targeting of mass exchange networks, Recycle strategies using property integration, Heat integration, combined heat and power integration Direct recycle, synthesis of mass and heat exchange, mass integration.		
UNIT 4	**Heat and Power Integration**	**7 HOURS**
Minimum utility target, Network for maximum energy recovery, Minimum number of heat exchangers, Optimum approach temperature, Heat integrated distillation trains and Multiple effect distillation.		
UNIT 5	**Integration of Process Design and Control**	**7 HOURS**
Control system configuration, Qualitative plant wide control system and Plant safety systems, Chemical process design case study.		
UNIT 6	**Introduction to Process Intensification**	**7 HOURS**
Process Intensification, methods of intensification, case studies like, mixing tank, reactors, separation processes.		

PRACTICAL		
PRACTICAL NO.01		**2 HOURS**
Heat exchange pinch analysis		
PRACTICAL NO.02		**2 HOURS**
Recycle strategies using property integration		
PRACTICAL NO.03		**2 HOURS**
Synthesis of mass exchange networks		
PRACTICAL NO.04		**2 HOURS**
Heat Exchanger Network		

PRACTICAL NO.05		**2 HOURS**
Intensification of mass transfer operation		
PRACTICAL NO.06		**5 HOURS**
Intensification of reacting system		
PRACTICAL NO.07		**4 HOURS**
Process integration and intensification for petrochemical plant		
PRACTICAL NO.08		**4 HOURS**
Process integration and intensification for fine chemical plant		
PRACTICAL NO.09		**2 HOURS**
Project		

TEXT BOOKS

1. Mahmoud M. El-Halwagi, Process Integration-Process Systems Engineering, Volume 7, Academic Press, 2006, ISBN: 9780123705237.
2. Ian C. Kemp, Pinch Analysis and Process Integration: A User Guide on Process Integration, 2nd Edition, Butterworth Heinemann, Elsevier, 2007, ISBN: 9780750682602.
3. David Reay, Colin Ramshaw, Adam Harvey,Process Intensification, 2nd Edition, Butterworth Heinemann, 2008, ISBN: 9870080983042.
4. Petar Sabev Varbanov, Sharifah Rafidah Wan WanAlwi, Zainuddin Abdul Manan, Jiri Klemes. Process Integration and Intensification Saving Energy, Water and Resources De Gruyter Textbook 1 st Edition 2014, ISBN: 3110306859, 9783110306859.

REFERENCE BOOKS

1. R. Smith, Chemical Process: Design and Integration, 1st Edition, Wiley, 2005, ISBN: 9781118699096.
2. Stankiewicz, A. and Moulijn,Re-engineering the Chemical Process Plants, Process Intensification, Marcel Dekker, 2003, ISBN: 0203913299.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF HUMANITIES AND ENGINEERING SCIENCES	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Engineering Economics
	COURSE CODE	HP401
	COURSE CREDITS	2
RELEASED DATE : 01/06/2019	**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	50	20	NIL	NIL	70

PRE-REQUISITE :

COURSE OBJECTIVES :

HP401.CEO.1: To enable the students to understand the basic concepts of Economics

HP401.CEO.2: To impart knowledge, with respect to practical applications of Economics .

COURSE OUTCOMES :

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

HP401.CO.1: The students would have understood the basic concepts of Economics.

HP401.CO.2: The students would have acquired knowledge, with respect to concepts, principles and practical applications of Economics, which govern the functioning of a firm/organization under different market conditions

HP401.CO.3: The course is designed to improve critical thinking, problem solving skills by using economic models and theories and predict economic relationships

HP401.CO.4: Students entering any profession in the workforce today must be able to utilize these basic economic principles. The course expected to develop critical understanding of current topics in economics and able to formulate their own opinions on economic issues

THEORY

UNIT 1	Introduction to Economics	6 HOURS

Economic Issues and Concepts; How Economist Work ; Theory of Demand & Supply; Meaning, Determinants, Law of Demand and Supply, Equilibrium between Demand & Supply; Elasticity of demand, price elasticity, income elasticity, cross elasticity.

UNIT 2	Micro Economics	6 HOURS

Revenue Concepts; Cost Concepts, Short run & Long run cost Concepts and curves, opportunity cost. Break even analysis; meaning, explanation, numerical. Markets; meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Competition , Oligopoly).

UNIT 3	Macro Economy	5 HOURS

National Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP,NDP, Personal income, disposal income. Inflation; meaning, types, causes, measures to control.

UNIT 4	Indian Economy	5 HOURS

Characteristics of an Indian Economy; Human Development Index(HDI); Concepts of Foreign Trade, Goods and Services Tax(GST); Micro Small and Medium Enterprise(MSME) ; Foreign Direct Investment(FDI);Unemployment: meaning, types, causes, remedies.

UNIT 5	Introduction to Banking & Money Market	6 HOURS

Banking; meaning, types, functions, Commercial Banks- Instruments in Operation of an Account, Central Bank- RBI; its functions, Concepts- CRR, Bank Rate, Repo Rate, Reverse Repo rate, SLR; Introduction to Money and Capital Market , Introduction to Fiscal policy- meaning and tools.

REFERENCE BOOKS

1. R.Paneerselvam :Engineering Economics, , PHI publication ISBN : 978-81-203-5172-1
2. Robbins S.P. and Decenzo David A :Fundamentals of Management: Essential Concepts and Applications, Pearson Education, ISBN-13: 9780133499919
3. N Gregory Mankiw : Economics: Principles of Economics, Cengage Learning ISBN-10: 1305585127
4. L.M. Prasad: Principles and Practices of Management ISBN-10: 9351610500; ISBN-13: 978-9351610502
5. Tripathy and Reddy :Principles of Management ISBN, 1259050572, 9781259050572
6. Dr. K. K. Dewett & M. H. Navalur, S. Chand :Modern Economic Theory ISBN, : 9788121924634 .

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	COURSE SYLLABI (2016 – 2020)	
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**AY:** 2019 - 2020
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEERING	**COURSE NAME**	Major Project-II
	COURSE CODE	CH432
	COURSE CREDITS	4
RELEASED DATE : 01/06/2019	**REVISION NO**	0.0

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

PRE-REQUISITE : CH403: Major Project-I

COURSE OBJECTIVES :

CH432.CEO.1: Follow the standard guideline to meet the objective for development of Project.
CH432.CEO.2: Test rigorously before deployment of Systems.
CH432.CEO.3: Verify and Validate the work Undertaken.
CH432.CEO.4: Consolidate the work and preparation of final report.

COURSE OUTCOMES :

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

CH432.CO.1: Show the evidence of independent evaluation.
CH432.CO.2: Critically analyzed the result and their implementation methodology.
CH432.CO.3: Validate the results with standard tools and techniques.
CH432.CO.4: Understand the importance of documentation and report writing.

PREAMBLE:

The objective of this Major Project-II to implement the full and final project and the report. After The remaining project work which consist of selection of approach / methodology / tools and techniques, Designing, installation, results and performance evaluation. Also includes the comparative analysis and validation of result. Should prepare the Project report as per format for satisfactory completion of work certified by concern project advisor and dean.

GUIDELINES:

In Project Work Stage-II, the student shall complete the remaining project work which consists of Selection of Methodology, Tools and Technology, Installations, Design, Implementations, testing, Results, performance analysis if applicable (discussions using data tables per parameter considered for the improvement with existing/known algorithms/systems) and comparative analysis and validation of results and conclusions. The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is the duly certified by the concerned advisor and Dean of the school. It is desirable to prepare and publish the conference or journal paper or IPR and publish with peer reviewed publishing agency. 10 marks will be awarded. Follow the guideline and formats as mentioned in guideline document.(Annexure-II).

TIMELINE:

1. Presentation of Project Review- 3 Project Progress Monitoring DRC review (Week 5th)
2. Presentation of Project Review 4 Project Progress Monitoring and Report Preparation (Week-8th)
3. Internal Examination/ Project Expo: Project-2 Demonstration and presentation- (Week 10th)
4. External Examination: Project-2 Demonstration and Presentation- (End semester-Week 12th or 13th)

ASSESSMENT:

1. Internal Assessment (TW)

a. Project Review -3 Progress Monitoring - 30 Marks

b. Project Review -4 Progress Monitoring and Report Preparation -30 Marks

c. Project Expo/ Examination- Evaluation Presentation and Demonstration- 30 Marks

d. Paper publication/presentation/IPR -10 Marks

2. Examination: Final Demonstration and presentation

a. Project presentation: 15 Marks

b. Project design / execution / demonstration : 20 Marks

c. Project Report preparation and documentation: 15 Marks

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MIT ACADEMY OF ENGINEERING, ALANDI

An Autonomous Institute Affiliated to

Savitribai Phule Pune University

Curriculum

For

Final Year

Bachelor of Technology in

Chemical Engineering

(Amendments for Semester Long Internship)

2016-2020

(With Effect from Academic Year: 2019-2020)

MIT Academy of Engineering

(An Autonomous Institute Affiliated to SPPU)

SEMESTER LONG INTERNSHIP: RULES AND REGULATIONS

(2016 - 2020)

1. ELIGIBILITY:

I. No live backlogs
II. CGPA of 8.50 and above
III. If Recruiter/s (MNCs) have asked for semester long internship to the selected student/s (before joining the organization after his / her graduation), then in special case recruited students can apply for the same. (Only criteria-I should be satisfied by the student)

Only students satisfying the above criteria can be permitted for semester-long internship in any MNCs / R&D laboratories such as DRDO, NCL, NEERI, CDAC and Institutions like IITs/ NITs / International institutes of repute.

2. DEADLINES:

For the current batch, the applications must be submitted by 30, November 2019 by all students desired to go for the semester long internship.

3. APPLICATION PROCEDURE:

The student must submit a proposal of the semester-long internship including details of the organization along with the details of the project in brief, copy of their CV and copies of mark sheet to the respective school Corporate Relations (CR) coordinator. The application must be as per the format given below.

Application for Internship Program

Sr. No.	Particulars	
1	Name of the applicant (in bold letters)	
2	Gender	
3	School	
4	Date of Birth & Age (as on date)	
5	Roll Number & PRN	
6	Address for correspondence with mobile / telephone number and email-id	
7	Name & address of the Institute / Industry	
8	Core Domain of Institute / Industry	
9	Contact details Supervisor / HR Mobile / Telephone number and email-id	
10	Period of internship	24-26 weeks
11	Details of the Project proposed	

Signatures

Student	**School Internship Coordinator**
Approved by:	
No. of credits proposed	6 / 10
Dean – School of _____ Engineering	MIT AOE Seal
Date:	

4. RULES AND CONDITIONS:

I. Sponsored project should be along the same track of the minor (Open Elective) chosen by the student. (desirable)

II. Semester long internship is applicable only in the 8th semester. The distribution of credits for the VIII semester is as follows

DC	Department Core	4 Credits
DE	Department Elective	3 Credits
OE	Open Elective	4 Credits
HSS	Humanities & Social science	2 Credits
SDP	Skill development and Project	4 Credits

III. For a student who are opting for a semester long internship, 10 credits (OE, HSS and SDP) will be awarded if OE is part of the internship otherwise 6 credits will be awarded.

IV. The equivalence courses for the DC, DE and OE are floated by the Schools.

V. The credits of DC, DE and OE should be earned through MOOC courses.

VI. If a student is not able to successfully earn the credits of the DC / DE / OE within the stipulated time, they will not be eligible for the graduation in the same academic year.

5.1 ASSESSMENT METHOD FOR SEMESTER LONG INTERNSHIP:

Credits for the semester-long internship need to be earned by the students by the following assessment in front of the panel.

I. The Panel for the evaluation should be 3 members (if 3 credits) or 4 members (if 5 credits). The composition of the team would be as follows.

- **a.** Dean, Respective School
- **b.** Project Guide
- **c.** CR Coordinator / Project Coordinator
- **d.** Project Guide (Industry)
- **e.** The domain expert (In case of 5 credits, as per the minor specialization)

II. Presentation I at the end of 45th day and presentation II at the end of 90th day from the start of the project combined to a total weightage of 5 credits **(3 credits if OE is exempted).** It can be possible to do through Skype, if acceptable to the panel. **In Grade card it will be mentioned as SLIP – Project Design.**

III. Presentation at the end of the Internship Work and Final Internship Report after the completion of the Internship Work combined for a total weightage of 5 credits **(3 credits if OE is exempted)** and should be as per the template). **In Grade card it will be mentioned as SLIP – Project Implementation.**

5.2 ASSESSMENT METHOD FOR OTHER COURSES RUN THROUGH INSTITUTE LMS:

Credits for the courses run through Go-Webinar will be assessed using the following methods.

I. There will be SIX assignments (one per unit) to be submitted through the moodle. This will have a weightage of 30% of the total score. This contributes to the IA for the course.

II. There will be SIX quizzes (one per unit) to be conducted through moodle. This will have a weightage of 30% of the total score. This contributes to the ISE for the course.

III. One FINAL presentation to be done at the end and evaluated by a team of THREE members including the Course Champion, Instructor and any other nominated member by the respective School Dean. This will have a weightage of 40% of the total score. This contributed for the ESE of the course.

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	CURRICULUM STRUCTURE (2016 - 2020)		
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**:**	**2019-20 (PART B)**
FINAL YEAR BACHELOR OF TECHNOLOGY CHEMICAL ENGINEEERING	**RELEASE DATE**	**:**	**1/12/2018**
	REVISION NO.	**:**	**0.0**

SEMESTER: VII

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC11	CH401	Process Dynamics, Control & Instrumentation	3	2	4
2.	DE1	CH41#	Dept. Elective	3	0	3
3.	OE3	CH42#	Open Elective	3	2	4
4.	HSS7	HP402	Sociology	2	---	2
5.	HSS8/ SDP7	HP403/ CH402	Business Strategies / Skill Development Lab 2	---	2	1
6.	SDP8	CH403	Project - I	---	8	4
7.	SDP9	CH404	Summer Internship	---	---	4
TOTAL				**11**	**14**	**22**

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

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC12	CH431	Chemical Process Technology @	4	0	4
2.	DE2	SWAYAM / NPTEL	Dept. Elective	3	0	3
3.	OE4	CH45#	Open Elective @	4	0	4
4.	SEMESTER LONG INTERNSHIP – Project Design			---	---	3
5.	SEMESTER LONG INTERNSHIP – Project Implementation			---	---	3
TOTAL				**7**	**---**	**17**

MIT Academy of Engineering (An Autonomous Institute Affiliated to SPPU)	**CURRICULUM STRUCTURE** **(2016 - 2020)**		
SCHOOL OF CHEMICAL ENGINEERING	**W.E.F**	**:**	**2019-20 (PART C)**
FINAL YEAR BACHELOR OF TECHNOLOGY **CHEMICAL ENGINEEERING**	**RELEASE DATE**	**:**	**1/12/2018**
	REVISION NO.	**:**	**0.0**

SEMESTER: VII

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC11	CH401	Process Dynamics, Control & Instrumentation	3	2	4
2.	DE1	CH41#	Dept. Elective	3	0	3
3.	OE3	CH42#	Open Elective	3	2	4
4.	HSS7	HP402	Sociology	2	---	2
5.	HSS8/ SDP7	HP403/ CH402	Business Strategies / Skill Development Lab 2	---	2	1
6.	SDP8	CH403	Project - I	---	8	4
7.	SDP9	CH404	Summer Internship	---	---	4
TOTAL				**11**	**14**	**22**

SEMESTER: VIII (SLIP inline with the Open elective)

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC12	CH431	Chemical Process Technology @	4	0	4
2.	DE2	SWAYAM / NPTEL	Dept. Elective	3	0	3
3.	SEMESTER LONG INTERNSHIP – Project Design			---	---	5
4.	SEMESTER LONG INTERNSHIP – Project Implementation			---	---	5
TOTAL				**7**	**---**	**17**

@ -- Courses run through institute LMS

DEPARTMENT ELECTIVE ON MOOCS PLATFORM			
SR. NO.	**COURSE DETAILS**	**MOOC DETAILS**	**NO. OF WEEKS**
1.	Computational Fluid Dynamics, Prof Srinivas Jayanti, IIT Madras	SWAYAM	12
2.	Environmental Quality Monitoring and Analysis, Prof Ravi Krishna, IIT Madras	SWAYAM	12
3.	Waste to Energy conversion, Prof P. Mondal, IIT Roorkee	NPTEL	8