VISION AND MISSION OF THE DEPARTMENT: APPLIED SCIENCE AND TECHNOLOGY

Vision of the Department	Provide the knowledge and prosperity through high quality education to next generation of visionaries by illuminating them to perform Engineering & Technologies and to have leadership management role in industry and research institutions.	
	Mission No.	**Mission Statements**
Mission of the Department	M1	To be centre of educational excellence in Petroleum Engineering & Safety programs by the global industries and other Educational institutions.
	M2	To train the students with expertise that would improve the skills and face the challenges in industry.
	M3	To provide the students with multi-disciplinary approach to come up with practical knowledge that would meet global demands.
	M4	To empower the students for advanced study and research in the field of upstream and downstream sectors in Petroleum Industries, Occupational Health and Environmental Management.

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Anna University, Chennai-600 025

ANNA UNIVERSITY: : CHENNAI: 600 025
UNIVERSITY DEPARTMENTS
B.TECH. PETROLEUM ENGINEERING AND TECHNOLOGY
REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM (CBCS)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :

I. To inculcate in students, a professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to solve problems encountered in petroleum and petrochemical sector.
II. To make the students conversant with principles of chemical engineering processes, fundamentals of petroleum and petrochemicals sector.
III. Gain knowledge in basic sciences, mathematics and solve engineering problems in petrochemical sector using C,Matlab and other computational tools.
IV. To help the students understand the theory, instrumentation and applications of analytical equipment used in industries for testing the quality of petroleum, intermediates and products.
V. Have a knowledge and competency in petroleum and oil refinery process industries complemented by the appropriate skills and attributes.

PROGRAMME OUTCOMES (POs):

After going through the four years of study, our Petroleum Engineering and Technology Graduates will exhibit ability to:

	Graduate attribute	Programme Outcome
PO1	Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals to extract oil and gas deposits below the earth's surface.
PO2	Problem analysis	Identify, formulate, the problems in upstream and downstream sector of petroleum engineer.
PO3	Design / development of solutions	Design of solutions for complex engineering problems and design system components in the process of drilling the well to extract gas or oil.
PO4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data.
PO5	Modern tool usage	Create, select and apply appropriate techniques and software tools problem in such a identification of reservoirs and design the product used for petrochemicals.
PO6	The Engineer and society	Contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Engineering Practice.
PO7	Environment and sustainability	Understand the environment impact and assessment in the arena of reservoir drilling and production of oil and gas.
PO8	Ethics	Apply ethical principles and commit to the standard

		of professional to practice behavior.
PO9	Individual and team work	Function effectively as an individual, member or leader in diverse teams, to accomplish all spheres of life- interpersonal, social and professional
PO10	Communication	Communicate effectively on complex engineering activities with the engineering community.
PO11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and to achieve specific goals and meet specific success criteria at this specified time.
PO12	Life-long learning	Recognize the need for the preparation, ability to engage independent and life- long learning achievementundertaken throughout life, with the aim of improving knowledge, skill and quality of life.

3. PROGRAM SPECIFIC OUTCOMES (PSOs):

By the completion of Petroleum Engineering and Technology program the student will have following Program specific outcomes.

1. Graduates will have career path as a reservoir, drilling and petroleum production engineer.
2. Graduates will have an ability to characterize and evaluate the subsurface geological formations and their resources.
3. Graduates will have an ability to acquire data of subsurface formation properties and interpret it.
4. Graduates will have an ability to extract oil or gas considering the economic value and environmental safety.

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
I	-	-	-	✓	-	-	-	✓	✓	✓	-	✓
II	-	✓	-	-	✓	-	✓	-	✓	-	-	-
III	✓	✓	✓	✓	✓	-	-	-	-	-	-	-
IV	-	-	-	✓	-	-	-	-	-	-	✓	✓
V	✓	✓	✓	-	✓	✓	✓	-	-	-	✓	✓

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MAPPING OF COURSEOUTCOMEANDPROGRAMMEOUTCOME

		CourseName	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
YEAR 1	Semester1	Technical English												
		Engineering Mathematics I												
		Engineering Physics												
		Engineering Chemistry												
		Engineering Graphics												
		Basic Sciences Laboratory												
		Workshop Practices Laboratory												
	Semester2	Professional Communication												
		Mathematics II												
		Problem Solving & Python Programming												
		Basics of Electrical and Electronics Engineering												
		Engineering Mechanics												
		Organic Chemistry	3	3	3	2		2					1	
		Problem Solving & Python Programming Practices Laboratory												
		Electrical and Electronics Engineering Laboratory												
YEAR 2	Semester3	Numerical Methods												
		Industrial Stoichiometry	3	3	3	3	-	2	3	-	-	-	3	-
		Fluids and Solid Operations	3	2	3	3	3	1	2	-	1	-	2	2
		Petroleum Geology and Geophysics	3	-	3	3	3	3	3	-	2	1	2	3
		Reservoir Engineering	3	3	3	3	3	2	3	2	2	-	2	1
		Elective - Humanities I	-	-	-	-	-	-			-		-	
		Fluids and Solid Operations Laboratory	3	3	3	3	3	3	3	-	2	2	2	1
		Organic Chemistry Laboratory	3	3	3	3	3	3	2	-	2	1	1	-
	Semester4	Total Quality Management												
		Environmental Sciences												
		Audit Course - I												
		Drilling Operations	3	3	3	3	3	3	2	3	2	1	1	
		Petroleum Refining and Petrochemicals	3	3	3	3	3		3					
		Process Heat Transfer	3	3	2	3	3							2

		Chemical Engineering Thermodynamics	3	3	3	2	2		2					
		Process Heat transfer Laboratory	3	3	2	3	2	2	2		3	3		
		Petroleum Geology and Geophysics Laboratory	3	3	2	3	3				3	2		

		Corse Name	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
YEAR 3	**Semester 5**	Audit Course - II												
		Well Completion Techniques	3	3	3	3	3		2					
		Natural Gas Engineering	3	3	2	2	3		1				1	
		Petroleum Production Engineering	3	3	3	3	3		2					3
		Mass Transfer	3	2	3	2	3							
		Professional Elective - I												
		Mass Transfer Laboratory	2	3	3	3	3	2			2	3		
		Petroleum Testing Laboratory	3	2	2	3	2	3	-	2	3	3		
	Semester 6	Elective - Humanities II												
		Petroleum Formation and Evaluation	3	2	3	2	3	2						2
		Flow Assurance in Petroleum Industries	3	2			2	2						
		Professional Elective - II												
		Professional Elective - III												
		Open Elective I												
		Employability Skills		3	3		2	3	1		3	2		
		Drilling Fluids and Cementing Laboratory	3	2	2	3	2				3	2		
YEAR	**Semester7**	Petroleum Equipment Design	3	2	3	2	2		2	2		2	3	
		Process Instrumentation Dynamics and Control	3	2	2	3	2	2						
		Water flooding and Enhanced Oil Recovery	3	2		3	2		2				3	
		Professional Elective - IV												
		Professional Elective - V												
		Open Elective II												

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		Process Control and simulation Laboratory		2	3	2	3				3	2		
		Internship / Training (Minimum 2 Weeks)	3	3		3	2		3				3	
		Project - I												
	Semester8	Project - II	3	3		3	2		3				3	
		Professional Elective - VI												
		Professional Elective - VII												

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ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
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REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM
CURRICULUM AND SYLLABI FOR I TO VIII SEMESTERS

SEMESTER I

SI. NO.	CODE NO.	COURSETITLE	CATE GORY	PERIODSPER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5151	Technical English	HSMC	4	0	0	4	4
2.	MA5158	Engineering Mathematics I	BSC	3	1	0	4	4
3.	PH5151	Engineering Physics	BSC	3	0	0	3	3
4.	CY5151	Engineering Chemistry	BSC	3	0	0	3	3
5.	GE5151	Engineering Graphics	ESC	1	0	4	5	3
PRACTICALS								
6.	BS5161	Basic Sciences Laboratory	BSC	0	0	4	4	2
7.	GE5162	Workshop Practices Laboratory	ESC	0	0	4	4	2
			TOTAL	**14**	**1**	**12**	**27**	**21**

SEMESTER II

SI. NO.	CODE NO.	COURSETITLE	CATE GORY	PERIODSPERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5251	Professional Communication	HSMC	4	0	0	4	4
2.	MA5252	Engineering Mathematics II	BSC	3	1	0	4	4
3.	GE5153	Problem Solving and Python Programming	ESC	3	0	0	3	3
4.	EE5251	Basics of Electrical and Electronics Engineering	ESC	3	0	0	3	3
5.	GE5152	Engineering Mechanics	ESC	3	1	0	4	4
6.	CY5252	Organic Chemistry	BSC	3	0	0	3	3
PRACTICALS								
7.	GE5161	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
8.	EE5261	Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2
			TOTAL	**19**	**2**	**8**	**29**	**25**

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SEMESTER III

SI. NO.	CODE NO.	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA5353	Numerical Methods	BSC	3	1	0	4	4
2.	AS5301	Industrial Stoichiometry	PCC	3	0	0	3	3
3.	AS5302	Fluids and Solid Operations	PCC	3	1	0	4	4
4.	AS5303	Petroleum Geology and Geophysics	PCC	3	0	0	3	3
5.	AS5304	Reservoir Engineering	PCC	3	0	0	3	3
6.		Elective - Humanities I	HSMC	3	0	0	3	3
PRACTICALS								
7.	AS5311	Fluids and Solid Operations Laboratory	PCC	0	0	4	4	2
8.	CY5361	Organic Chemistry Laboratory	BSC	0	0	4	4	2
			TOTAL	**18**	**2**	**8**	**28**	**24**

SEMESTER IV

SI. NO.	CODE NO.	COURSETITLE	CATE GORY	PERIODSPERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GE5451	Total Quality Management	HSMC	3	0	0	3	3
2.	GE5251	Environmental Sciences	BSC	3	0	0	3	3
3.		Audit Course - I*	AC	3	0	0	3	0
4.	AS5401	Drilling Operations	PCC	3	0	0	3	3
5.	AS5402	Petroleum Refining and Petrochemicals	PCC	3	0	0	3	3
6.	AS5403	Process Heat Transfer	PCC	3	0	0	3	3
7.	AS5404	Chemical Engineering Thermodynamics	PCC	3	1	0	4	4
PRACTICALS								
8.	AS5413	Process Heat transfer Laboratory	PCC	0	0	4	4	2
9.	AS5412	Petroleum Geology and Geophysics Laboratory	PCC	0	0	2	2	1
			TOTAL	**21**	**1**	**6**	**28**	**22**

*Audit Course is optional

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SEMESTER V

SI. NO.	CODE NO.	COURSETITLE	CATEGORY	PERIODSPERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Audit Course - II*	AC	3	0	0	3	0
2.	AS5501	Well Completion Techniques	PCC	3	0	0	3	3
3.	AS5502	Natural Gas Engineering	PCC	3	0	0	3	3
4.	AS5503	Petroleum Production Engineering	PCC	3	0	0	3	3
5.	AS5504	Mass Transfer	PCC	3	1	0	4	4
6.		Professional Elective I	PEC	3	0	0	3	3
PRACTICALS								
7.	AS5511	Mass Transfer Laboratory	PCC	0	0	4	4	2
8.	AS5512	Petroleum Testing Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**1**	**8**	**27**	**20**

* Audit Course is optional

SEMESTER VI

SI. NO.	CODE NO.	COURSETITLE	CATEGORY	PERIODSPERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Elective - Humanities II	HSMC	3	0	0	3	3
2.	AS5601	Petroleum Formation Evaluation	PCC	3	0	0	3	3
3.	AS5602	Flow Assurance in Petroleum Industries	PCC	3	0	0	3	3
4.		Professional Elective II	PEC	3	0	0	3	3
5.		Professional Elective III	PEC	3	0	0	3	3
6.		Open Elective I	OEC	3	0	0	3	3
PRACTICALS								
7.	HS5461	Employability Skills	EEC	0	0	4	4	2
8.	AS5611	Drilling Fluids and Cementing Laboratory	PCC	0	0	2	2	1
9.	AS5712	Internship / Training (Minimum 2 Weeks)	EEC	-	-	-	-	-
			TOTAL	**18**	**0**	**6**	**24**	**21**

*Students shall undergo Internship / Trainingfor a minimum period of 2 weeks and assessment of the same will be doneduring seventh semester

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SEMESTER VII

SI. NO.	CODE NO.	COURSETITLE	CATE GORY	PERIODSPERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AS5701	Petroleum Equipment Design	PCC	3	0	0	3	3
2.	AS5702	Process Instrumentation Dynamics and Control	PCC	3	0	0	3	3
3.	AS5703	Water flooding and Enhanced Oil Recovery	PCC	3	0	0	3	3
4.		Professional Elective IV	PEC	3	0	0	3	3
5.		Professional Elective V	PEC	3	0	0	3	3
6.		Open Elective II	OEC	3	0	0	3	3
PRACTICALS								
7.	AS5711	Process Control and Simulation Laboratory	PCC	0	0	2	2	1
8.	AS5712	Internship / Training(Minimum 2 Weeks)	EEC	0	0	2	2	1
9.	AS5713	Project I	EEC	0	0	6	6	3
			TOTAL	**18**	**0**	**10**	**28**	**23**

SEMESTER VIII

SI. NO.	CODE NO.	COURSETITLE	CATE GORY	PERIODSPERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective VI	PEC	3	0	0	3	3
2.		Professional Elective VII	PEC	3	0	0	3	3
PRACTICALS								
3.	AS5811	Project II	EEC	0	0	16	16	8
			TOTAL	**6**	**0**	**16**	**22**	**14**

TOTAL NO. OF CREDITS:170

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PROFESSIONAL ELECTIVES (PEC)

SI. NO.	CODE NO.	COURSETITLE	CATE GORY	PERIODSPERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AS5015	Petroleum Chemistry	PEC	3	0	0	3	3
2.	AS5016	Oil and Gas Well Testing	PEC	3	0	0	3	3
3.	AS5017	Offshore Drilling and Production Practices	PEC	3	0	0	3	3
4.	AS5018	Reservoir Characterization and Modeling	PEC	3	0	0	3	3
5.	AS5019	Integrated Oil and Gas reservoir Management	PEC	3	0	0	3	3
6.	AS5020	Petroleum Economics	PEC	3	0	0	3	3
7.	IB5073	Chemical Reaction Engineering	PEC	3	0	0	3	3
8.	AS5021	Petroleum Corrosion Technology	PEC	3	0	0	3	3
9.	AS5022	Refinery process design	PEC	3	0	0	3	3
10.	AS5023	Product Design and development for Petrochemical Engineers	PEC	3	0	0	3	3
11.	AS5024	Unconventional Hydrocarbon Sources	PEC	3	0	0	3	3
12.	AS5025	Design of Pressure Vessels and Piping	PEC	3	0	0	3	3
13.	AS5026	Supply Chain Management for Petrochemical Engineers	PEC	3	0	0	3	3
14.	AS5073	Process Plant Utilities	PEC	3	0	0	3	3
15.	AS5027	Plant Safety and Risk Analysis	PEC	3	0	0	3	3
16.	AS5028	Multicomponent Distillation	PEC	3	0	0	3	3
17.	AS5029	Safety and Environment Health	PEC	3	0	0	3	3
18.	AS5030	Process Engineering	PEC	3	0	0	3	3
19.	CH5071	Energy Technology	PEC	3	0	0	3	3
20.	GE5071	Disaster Management	PEC	3	0	0	3	3
21.	CH5751	Transport Phenomena	PEC	3	0	0	3	3
22.	AS5031	Spectroscopic Techniques for Petroleum Engineers	PEC	3	0	0	3	3
23.	AS5032	Introduction to Polymer Technology	PEC	3	0	0	3	3

PROFESSIONAL CORE (PCC)

Sl. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	AS5301	Industrial Stoichiometry	PCC	3	3	0	0	3
2.	AS5302	Fluids and Solid operations	PCC	3	3	1	0	4
3.	AS5303	Petroleum Geology and Geophysics	PCC	3	3	0	0	3
4.	AS5304	Reservoir Engineering	PCC	3	3	0	0	3
5.	AS5311	Fluids and Solid operations Laboratory	PCC	4	0	0	4	2
6.	AS5401	Drilling Operations	PCC	3	3	0	0	3
7.	AS5402	Petroleum Refining and Petrochemicals	PCC	3	3	0	0	3
8.	AS5403	Process Heat Transfer	PCC	3	3	0	0	3
9.	AS5404	Chemical Engineering Thermodynamics	PCC	3	3	1	0	4
10.	AS5413	Process Heat Transfer Laboratory	PCC	4	0	0	4	2
11.	AS5412	Petroleum Geology and Geophysics Laboratory	PCC	2	0	0	2	1
12.	AS5501	Well Completion Techniques	PCC	3	3	0	0	3
13.	AS5502	Natural Gas Engineering	PCC	3	3	0	0	3
14.	AS5503	Petroleum Production Engineering	PCC	3	3	0	0	3
15.	AS5504	Mass Transfer	PCC	3	3	1	0	4
16.	AS5511	Mass Transfer Laboratory	PCC	4	0	0	4	2
17.	AS5512	Petroleum Testing Laboratory	PCC	4	0	0	4	2
18.	AS5601	Petroleum Formation and Evaluation	PCC	3	3	0	0	3
19.	AS5602	Flow Assurance in Petroleum Industries	PCC	3	3	0	0	3
20.	AS5611	Drilling Fluids and Cementing Laboratory	PCC	2	0	0	2	1
21.	AS5701	Petroleum Equipment Design	PCC	3	3	0	0	3
22.	AS5702	Process Instrumentation Dynamics and Control	PCC	3	3	0	0	3
23.	AS5703	Water Flooding and Enhanced Oil Recovery	PCC	3	3	0	0	3
24.	AS5711	Process Control and Simulation Laboratory	PCC	2	0	0	2	1

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HUMANITIESANDSOCIALSCIENCES INCLUDING MANAGEMENT COURSES(HSMC)						
Sl. No.	**Course No.**	**Course Title**	**L**	**T**	**P**	**C**
1.	HS5151	Technical English	4	0	0	4
2.	HS5251	Professional Communication	4	0	0	4
3.	GE5451	Total Quality Management	3	0	0	3
					Total Credits	**11**

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	HU5171	Language and Communication	3	0	0	3
2.	HU5172	Values and Ethics	3	0	0	3
3.	HU5173	Human Relations at Work	3	0	0	3
4.	HU5174	Psychological Process	3	0	0	3
5.	HU5175	Education, Technology and Society	3	0	0	3
6.	HU5176	Philosophy	3	0	0	3
7.	HU5177	Applications of Psychology in Everyday Life	3	0	0	3

HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	HU5271	Gender Culture and Development	3	0	0	3
2.	HU5272	Ethics and Holistic Life	3	0	0	3
3.	HU5273	Law and Engineering	3	0	0	3
4.	HU5274	Film Appreciation	3	0	0	3
5.	HU5275	Fundamentals of Language and Linguistics	3	0	0	3
6.	HU5276	Understanding Society and Culture through Literature	3	0	0	3

BASIC SCIENCE COURSE(BSC)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1.	MA5158	Engineering Mathematics I	3	1	0	4
2.	PH5151	Engineering Physics	3	0	0	3
3.	CY5151	Engineering Chemistry	3	0	0	3
4.	BS5161	Basic Science Laboratory	0	0	4	2
5.	MA5252	Engineering Mathematics II	3	1	0	4
6.	CY5252	Organic Chemistry	3	0	0	3
7.	MA5353	Numerical Methods	3	1	0	4
8.	CY5361	Organic Chemistry Laboratory	0	0	4	2
9.	GE5251	Environmental Sciences	3	0	0	3
					Total Credits	**28**

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ENGINEERING SCIENCE COURSE(ESC)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1.	GE5151	Engineering Graphics	1	0	4	3
2.	GE5162	Workshop Practices Laboratory	0	0	4	2
3.	GE5153	Problem Solving and Python Programming	3	0	0	3
4.	EE5251	Basics of Electrical and Electronics Engineering	3	0	0	3
5.	GE5152	Engineering Mechanics	3	1	0	4
6.	EE5261	Electrical and Electronics Engineering Laboratory	0	0	4	2
7.	GE5161	Problem Solving and Python Programming Laboratory	0	0	4	2
					Total Credits	**19**

EMPLOYABILITY ENHANCEMENT COURSES (EEC)						
Sl. No.	**CODE No.**	**COURSE TITLE**	**L**	**T**	**P**	**Credits**
1.	HS5461	Employability Skills	0	0	4	2
2.	AS5712	Internship / Training (Minimum 2 Weeks)	0	0	2	1
3.	AS5713	Project I	0	0	6	3
4.	AS5811	Project II	0	0	16	8
					Total Credits	**14**

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

Sl. No.	Course Code	Course Title	Periods per week			Credits	Semester
			Lecture	Tutorial	Practical		
1.	AD5091	Constitution of India	3	0	0	0	2/6
2.	AD5092	Value Education	3	0	0	0	
3.	AD5093	Pedagogy Studies	3	0	0	0	
4.	AD5094	Stress Management by Yoga	3	0	0	0	
5.	AD5095	Personality Development Through Life Enlightenment Skills	3	0	0	0	
6.	AD5096	Unnat Bharat Abhiyan	3	0	0	0	
7.	AD5097	Essence of Indian Knowledge Tradition	3	0	0	0	
8.	AD5098	Sanga Tamil Literature Appreciation	3	0	0	0	

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Summary

Name of the Programme										
Sl. No.	Subject Area / Category	Credits per Semester								Credits Total
		1	2	3	4	5	6	7	8	
1.	Humanities and Social Sciences including Management Courses (HSMC)	4	4	3	3	-	3	-	-	17
2.	Basic Science Courses (BSC)	12	7	6	3	-	-	-	-	28
3.	Engineering Science Courses (ESC)	5	14	-	-	-	-	-	-	19
4.	Professional Core Courses (PCC) Including Lab Courses	-	-	15	16	17	7	10	-	65
5.	Professional Elective (PEC)	-	-	-	-	3	6	6	6	21
6.	Open Electives (OEC)	-	-	-	-	-	3	3	-	6
7.	Project work, seminar and internship in industry or elsewhere (EEC)	-	-	-	-	-	2	4	8	14
8.	Audit Course (Non Credit)	-	-	-	-	-	-	-	-	-
	TOTAL	21	25	24	22	20	21	23	14	**170**

Attested

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HS5151 **TECHNICAL ENGLISH** **L T P C**
4 0 0 4

OBJECTIVES:

The first semester English course entitled 'Technical English ' aims to,

- Familiarise first year students of engineering and technology with the fundamental aspects of technical English.
- Develop all the four language skills by giving sufficient practice in the use of the skills in real life contexts.
- Enhance the linguistic and communicative competence of first year engineering and technology students.

UNIT I INTRODUCING ONESELF **12**

Listening: Listening and filling a form, listening to speeches by specialists from various branches of engineering and completing activities such as answering questions, identifying the main ideas of the listening text, style of the speaker (tone and tenor) – **Speaking**: Introducing oneself –introducing friend/ family - **Reading:** Descriptive passages (from newspapers / magazines)- **Writing**: Writing a paragraph (native place, school life)- **Grammar:** Simple present, present continuous – **Vocabulary Development**: One word substitution

UNIT II DIALOGUE WRITING **12**

Listening: Listening to conversations (asking for and giving directions) –**Speaking:** making conversation using (asking for directions, making an enquiry), Role plays-dialogues- **Reading:** Reading a print interview and answering comprehension questions-**Writing**: Writing a checklist, Dialogue writing- **Grammar**: Simple past – question formation (Wh- questions, Yes or No questions, Tag questions)- **VocabularyDevelopment**: Stress shift, lexical items related to the theme of the given unit.

UNIT III FORMAL LETTER WRITING **12**

Listening: Listening to speeches by famous people and identifying the central message of the speech – answering multiple-choice questions)-**Speaking:** Giving short talks on a given topic-**Reading:** Reading motivational essays on famous engineers and technologists (answering open-ended and closed questions)- **Writing:** Writing formal letters/ emails (Complaint letters)-**Grammar**: Future Tense forms of verbs, subject and verb agreement-**Vocabulary Development**: Collocations – Fixed expressions

UNIT IV WRITING COMPLAINT LETTERS **12**

Listening: Listening to short talks (5 minutes duration and fill a table, gap-filling exercise) note taking/note making- **Speaking:** Small group discussion, giving recommendations-**Reading:** Reading problem – solution articles/essays drawn from various sources- **Writing:** Making recommendations – Writing a letter/ sending an email to the Editor- note making- **Grammar:** Modals – Phrasal verbs – cause and effect sentences- **Vocabulary Development**: Connectives, use of cohesive devices in writing, technical vocabulary.

UNIT V WRITING DEFINITIONS AND PRODUCT DESCRIPTION **12**

Listening: Listening to a product description (labeling and gap filling) exercises- **Speaking:** Describing a product and comparing and contrasting it with other products- **Reading**: Reading graphical material for comparison (advertisements)-**Writing:** Writing Definitions (short and long) – compare and contrast paragraphs- **Grammar:** Adjectives – Degrees of comparison - compound nouns- **Vocabulary Development**: Use of discourse markers – suffixes (adjectival endings).

TOTAL : 60 PERIODS

Learning Outcomes

At the end of the course the students will have gained,

- Exposure to basic aspects of technical English.
- The confidence to communicate effectively I various academic situations.
- Learnt the use of basic features of Technical English

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Textbook:

1. Revised Edition of 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited 2019.

Assessment Pattern

- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

MA5158	ENGINEERING MATHEMATI CS – I (Common to all branches of B.E. / B.Tech. Programmes in I Semester)	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
  - To familiarize the student with functions of several variables. This is needed in many branches of engineering.
  - To make the students understand various techniques of integration.
  - To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I MATRICES **12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS **12**

Limit of function – One sided limit – Limit Laws – Continuity – left and right continuity – types of discontinuities – Intermediate Value Theorem – Derivatives of a function - Differentiation rules – Chain rule – Implicit differentiation – logarithmic differentiation – Maxima and minima – Mean value theorem – (Optional: Polar coordinate system – Differentiation in polar coordinates).

UNIT III FUNCTIONS OF SEVERAL VARIABLES **12**

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS **12**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT V MULTIPLE INTEGRALS **12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL :60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

- Use the matrix algebra methods for solving practical problems.
- Apply differential calculus tools n solving various application problems.

- Able to use differential calculus ideas on several variable functions.
- Apply different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXTBOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017.
2. James Stewart, "Calculus with Early Transcendental Functions", Cengage Learning, 6th Edition, New Delhi,2013.
3. Joel Hass, Christopher Heil and Maurice D.Weir, "Thomas' Calculus", Pearson, 14th Edition, New Delhi, 2018.
4. Narayanan S. and Manicavachagom Pillai T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2015.
3. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education2nd Edition, 5th Reprint, Delhi, 2009.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics",Narosa Publications, 5th Edition, New Delhi, 2017.
5. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi , 2012.
6. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.

PH5151 ENGINEERING PHYSICS L T P C

(Common to all branches of B.E / B.Tech programmes) **3 0 0 3**

OBJECTIVE

- To make the students in understanding the importance of mechanics.
- To equip the students on the knowledge of electromagnetic waves.
- To introduce the basics of oscillations, optics and lasers.
- To enable the students in understanding the importance of quantum physics.
- To elucidate the application of quantum mechanics towards the formation of energy bands in crystalline materials.

UNIT I MECHANICS 9

Moment of inertia (M.I) - Radius of gyration - Theorems of M .I - M.I of circular disc, solid cylinder , hollow cylinder , solid sphere and hollow sphere - K.E of a rotating body – M.I of a diatomic molecule – Rotational energy state of a rigid diatomic molecule - centre of mass – conservation of linear momentum – Relation between Torque and angular momentum - Torsional pendulum.

UNIT II ELECTROMAGNETIC WAVES 9

Gauss's law – Faraday's law - Ampere's law - The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS 9

Simple harmonic motion - resonance - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect - reflection and refraction of light waves - total internal reflection - interference - interferometers - air wedge experiment. Theory of laser -

characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO_2 laser, semiconductor laser - applications.

UNIT IV BASIC QUANTUM MECHANICS 9

Photons and light waves - Electrons and matter waves - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization - Particle in a infinite potential well - Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS 9

The harmonic oscillator - Barrier penetration and quantum tunneling - Tunneling microscope - Resonant diode - Finite potential wells - particle in a three dimensional box - Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

OUTCOME

After completion of this course, the students should able to

- Understanding the importance of mechanics.
- Express the knowledge of electromagnetic waves.
- Know the basics of oscillations, optics and lasers.
- Understanding the importance of quantum physics.
- Apply quantum mechanical principles towards the formation of energy bands in crystalline materials.

TEXT BOOKS

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education, 2017.
2. D.Halliday, R.Resnick and J.Walker. Principles of Physics. John Wiley & Sons, 2015.
3. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer- Verlag, 2012.

REFERENCES

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson, 2016.
2. D.J.Griffiths. Introduction to Electrodynamics. Pearson Education, 2015
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications. Springer, 2012.

CY5151 **ENGINEERING CHEMISTRY** **L T P C**
(COMMON TO ALL BRANCHES) **3 0 0 3**

OBJECTIVES:

- To introduce the basic concepts of polymers, their properties and some of the important applications.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To facilitate the understanding of the laws of photochemistry, photoprocesses and instrumentation & applications of spectroscopic techniques.
- To familiarize the operating principles and applications of energy conversion, its processes and storage devices.
- To inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I POLYMER CHEMISTRY **9**

Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Structure, Properties and uses of: PE, PVC, PC, PTFE, PP, Nylon 6, Nylon 66, Bakelite, Epoxy; Conducting polymers – polyaniline and polypyrrole.

UNIT II NANOCHEMISTRY **9**

Basics-distinction between molecules, nanomaterials and bulk materials; size-dependent properties. Types –nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Characterization - Scanning Electron Microscope and Transmission Electron Microscope - Principle and instrumentation (block diagram). Properties (optical, electrical, mechanical and magnetic) and Applications of nanomaterials - medicine, agriculture, electronics and catalysis.

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY **9**

Photochemistry: Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law (derivation and problems). Photo physical processes – Jablonski diagram. Chemiluminescence, photo-sensitization and photoquenching – mechanism and examples. Spectroscopy: Electromagnetic spectrum - absorption of radiation - electronic, vibrational and rotational transitions. Width and intensities of spectral lines. Atomic absorption spectroscopy, UV-Vis and IR spectroscopy- principles, instrumentation (Block diagram) and applications.

UNIT IV ENERGY CONVERSIONS AND STORAGE **9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant – fast breeder reactor. Solar energy conversion - solar cells. Wind energy. Batteries - types of batteries – primary battery (dry cell), secondary battery (lead acid, nickel-cadmium and lithium-ion-battery). Fuel cells – H_2-O_2 and microbial fuel cell. Explosives – classification, examples: TNT, RDX, Dynamite; Rocket fuels and propellants – definition and uses.

UNIT V WATER TECHNOLOGY **9**

Water – sources and impurities – water quality parameters: colour, odour, pH, hardness, alkalinity, TDS, COD and BOD. Boiler feed water – requirement – troubles (scale & sludge, caustic embrittlement, boiler corrosion and priming & foaming. Internal conditioning – phosphate, calgon and carbonate treatment. External conditioning - zeolite (permutit) and ion exchange demineralization. Municipal water treatment process – primary (screening, sedimentation and coagulation), secondary (activated sludge process and trickling filter process) and tertiary (ozonolysis, UV treatment, chlorination, reverse osmosis).

TOTAL: 45 PERIODS

OUTCOMES:

- To recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- To identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
- To demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS:

1. Jain P. C. & Monica Jain., "Engineering Chemistry", 16th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. S.S.Dara, "A text book of Engineering Chemistry", Chand Publications, 2014.

REFERENCE BOOKS:

1. Schdeva M V, "Basics of Nano Chemistry", Anmol Publications Pvt Ltd
2. B.Sivasankar, "Instrumental Methods of Analysis", Oxford University Press. 2012.
3. Friedrich Emich, "Engineering Chemistry", Scientific International Ltd.
4. V RGowariker, N V Viswanathan and Jayadev Sreedhar, "Polymer Science" New AGE International Publishers, 2009.

GE5151 ENGINEERING GRAPHICS LTPC 1043

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:

1. Drawing free hand sketches of basic geometrical shapes and multiple views of objects.
2. Drawing orthographic projections of lines and planes.
3. Drawing orthographic projections of solids.
4. Drawing development of the surfaces of objects.
5. Drawing isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) 1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNITI PLANE CURVES AND FREE HANDSKETCHING 14

Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by different methods – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNITII PROJECTION OF POINTS, LINES AND PLANE SURFACES 15

Orthographic projection- principles-Principle planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes-Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNITIII PROJECTION OF SOLIDS 15

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.

UNITIV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 15

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNITV ISOMETRIC AND PERSPECTIVE PROJECTIONS 12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3

Introduction to drafting packages and demonstration of their use

TOTAL (L: 15 + P: 60)=75 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids
4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids.

TEXT BOOKS:

1. Bhatt, N. D.,Panchal V M and Pramod R. Ingle, “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2014.
2. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015

REFERENCES:

1. Agrawal, B. and Agrawal C.M., “Engineering Drawing”, Tata McGraw, N.Delhi, 2008.
2. Gopalakrishna, K. R., “Engineering Drawing”, Subhas Stores, Bangalore, 2007.
3. Natarajan, K. V., “A text book of Engineering Graphics”, 28th Ed., Dhanalakshmi Publishers, Chennai, 2015.
4. Shah, M. B., and Rana, B. C., “Engineering Drawing”, Pearson, 2nd Ed., 2009.
5. Venugopal, K. and Prabhu Raja, V., “Engineering Graphics”, New Age,2008.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

Attested

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only.
4. The students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day.

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BS5161 **BASIC SCIENCES LABORATORY** **L T P C**

(Common to all branches of B.E. / B.Tech Programmes) **0 0 4 2**

PHYSICS LABORATORY: (Any Seven Experiments)

OBJECTIVE

- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves and band gap determination.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young's modulus
3. Uniform bending – Determination of young's modulus
4. Lee's disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
9. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box -Determination of Band gap of a semiconductor.
12. Spectrometer- Determination of wavelength using gating.
13. Photoelectric effect
14. Michelson Interferometer.
15. Estimation of laser parameters.
16. Melde's string experiment

TOTAL: 30 PERIODS

OUTCOME

Upon completion of the course, the students will be able

- To determine various moduli of elasticity and also various thermal and optical properties of materials.
- To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

CHEMISTRY LABORATORY: (Minimum of 8 experiments to be conducted)

OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and polymers by spectroscopy and viscometry methods.

LIST OF EXPERIMENTS:

1. Estimation of HCl using Na2CO3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler"s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.

8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:

- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To determine the molecular weight of polymers by viscometric method.
- To quantitatively analyse the impurities in solution by electroanalytical techniques
- To design and analyse the kinetics of reactions and corrosion of metals

TEXTBOOKS:

1. Laboratory Manual- Department of Chemistry, CEGC, Anna University (2014).
2. Vogel"s Textbook of Quantitative Chemical Analysis (8th edition, 2014).

GE5162 WORKSHOP PRACTICES LABORATORY L T P C
(Common to all Branches of B.E. / B.Tech. Programmes) 0 0 4 2

COURSE OBJECTIVES: The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

Attested

WOOD WORK:

a) Sawing,
b) Planning and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

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Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

WIRING WORK:

a) Wiring Switches, Fuse, Indicator and Lamp etc. such as in basic household,
b) Wiring Stair case light.
c) Wiring tube – light.
d) Preparing wiring diagrams for a given situation.

Wiring Study:

a) Studying an Iron-Box wiring.
b) Studying a Fan Regulator wiring.
c) Studying an Emergency Lamp wiring.

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an air conditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

a) Studying a FM radio.
b) Studying an electronic telephone.

TOTAL (P: 60) = 60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

SEMESTER II

HS5251 PROFESSIONAL COMMUNICATION L T P C

4 0 0 4

COURSE OBJECTIVES

The course entitles 'professional communication'aims to,

- Improve the relevant language skills necessary for professional communication.
- Develop linguistic and strategic competence in workplace context.
- Enhance language proficiency and thereby the employability of budding engineers and technologists.

UNIT I TECHNICAL COMMUNICATION 12

Listening: Listening to telephone conversations (intent of the speaker and note taking exercises)- Speaking: Role play exercises based on workplace contexts, introducing oneself- Reading: Reading the interview of an achiever and completing exercises (skimming, scanning and predicting)- Writing: Writing a short biography of an achiever based on given hints- Grammar: Asking and answering questions, punctuation in writing, prepositional phrases- Vocabulary Development: use of adjectives.

UNIT II SUMMARY WRITING 12

Listening: Listening to talks/lectures both general and technical and summarizing the main points- Speaking: Participating in debates- Reading: Reading technical essays/ articles and answering comprehension questions-Writing: Summary writing-Grammar: Participle forms, relative clauses- Vocabulary Development: Use of compound words, abbreviations and acronyms.

UNIT III PROCESS DESCRIPTION 12

Listening: Listening to a process description and drawing a flowchart-Speaking: Participating in Group Discussions, giving instructions- Reading: Reading instruction manuals- Writing: Writing process descriptions- Writing instructions- Grammar: Use of imperatives, active and passive voice, sequence words- Vocabulary Development: Technical jargon

UNIT IV REPORT WRITING 12

Listening: Listening to a presentation and completing gap-filling exercises- Speaking: Making formal presentations- Reading: Reading and interpreting charts/tables and diagrams- Writing: Interpreting charts/tables and diagrams, writing a report- Grammar: Direct into indirect speech, use of phrases- Vocabulary Development: reporting words

UNIT V WRITING JOB APPLICATIONS 12

Listening: Listening to a job interview and completing gap=filling exercises- Speaking: Mock interview, telephone interviews- Reading: Reading a job interview, SOP, company profile and completing comprehension exercises- Writing: job applications and resumes and SOPs-Grammar: Present perfect and continuous tenses- Vocabulary Development: Technical vocabulary.

TOTAL : 60 PERIODS

LEARNING OUTCOMES

At the end of the second semester the learners should be able to,

- Read and comprehend technical texts effortlessly.
- Write reports of a technical kind.
- Speak with confidence in interviews and thereby gain employability

Textbook

1. Revised Edition of 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited 2019.

Assessment Pattern

- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

MA5252	ENGINEERING MATHEMATICS – II (Common to all branches of B.E. / B.Tech. Programmes in II Semester)	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.
- To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To acquaint the students with Differential Equations which are significantly used in Engineering problems.
- To make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS **12**

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's theorem, Stoke's theorem and Gauss divergence theorem – Verification and application in evaluating line, surface and volume integrals.

UNIT II ANALYTIC FUNCTION **12**

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions - Bilinear transformation $w = c + z,\ az,\ 1/z,\ z^2$.

UNIT III COMPLEX INTEGRATION **12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT IV DIFFERENTIAL EQUATIONS **12**

Method of variation of parameters – Method of undetermined coefficients – Homogenous equations of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT V LAPLACE TRANSFORMS **12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorems – Inverse Transforms – Convolution Theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 60 PERIODS

OUTCOMES:

Upon successful completion of the course, students will be able to:

- Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.
- Construct analytic functions and use their conformal mapping property in application problems.
- Evaluate real and complex integrals using the Cauchy's integral formula and residue theorem.
- Apply various methods of solving differential equation which arise in many application problems.
- Apply Laplace transform methods for solving linear differential equations.

TEXTBOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2015.
2. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, 44th Edition, New Delhi, 2017.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Glyn James, “Advanced Modern Engineering Mathematics”, Pearson Education, 4th Edition, New Delhi, 2011.
3. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, 5th Edition, New Delhi, 2017.
4. Peter V.O’Neil, “Advanced Engineering Mathematics”, Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012.
5. Ramana B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.

GE5153 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I INTRODUCTION TO COMPUTING AND PROBLEM SOLVING 9

Fundamentals of Computing – Computing Devices – Identification of Computational Problems – Pseudocodesand Flowcharts – Instructions – Algorithms – Building Blocks of Algorithms – Introduction to Python Programming – Python Interpreter and Interactive Mode – Variables and Identifiers – Arithmetic Operators– Values and Types – Statements.

Suggested Activities:

- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic operations.
- Installing Python.
- Simple programs on print statements, arithmetic operations.

Suggested Evaluation Methods:

- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.

UNIT II CONDITIONALS AND FUNCTIONS 9

Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.

Suggested Activities:

- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions.
- Implementation of a simple calculator.
- Developing simple applications like calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and iterative statements.
- External learning - Recursion vs. Iteration.

Suggested Evaluation Methods:

- Tutorials on the above activities.
- Group Discussion on external learning.

UNIT III SIMPLE DATA STRUCTURES IN PYTHON 10

Introduction to Data Structures – List – Adding Items to a List – Finding and Updating an Item – Nested Lists – Cloning Lists – Looping Through a List – Sorting a List – List Concatenation – List Slices – List Methods – List Loop – Mutability – Aliasing – Tuples: Creation, Accessing, Updating, Deleting Elements in a Tuple, Tuple Assignment, Tuple as Return Value, Nested Tuples, Basic Tuple Operations – Sets.

Suggested Activities:

- Implementing python program using lists, tuples, sets for the following scenario:
  Simple sorting techniques
  Student Examination Report
  Billing Scheme during shopping.
- External learning - List vs. Tuple vs. Set – Implementing any application using all the three data structures.

Suggested Evaluation Methods:

- Tutorials on the above activities.
- Group Discussion on external learning component.

UNIT IV STRINGS, DICTIONARIES, MODULES 10

Strings: Introduction, Indexing, Traversing, Concatenating, Appending, Multiplying, Formatting, Slicing, Comparing, Iterating – Basic Built-In String Functions – Dictionary: Creating, Accessing, Adding Items, Modifying, Deleting, Sorting, Looping, Nested Dictionaries Built-in Dictionary Function – Finding Key and Value in a Dictionary – Modules – Module Loading and Execution – Packages – Python Standard Libraries.

Suggested Activities:

- Implementing Python program by importing Time module, Math package etc.
- Creation of any package (student's choice) and importing into the application.

Suggested Evaluation Methods:

- Tutorials on the above activities.

UNIT V FILE HANDLING AND EXCEPTION HANDLING 7

Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

Suggested Activities:

- Developing modules using Python to handle files and apply various operations on files.
- Usage of exceptions, multiple except blocks -for applications that use delimiters like age, range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.

Attested

Suggested Evaluation Methods:

- Tutorials on the above activities.
- Case Studies.

TOTAL: 45 PERIODS

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OUTCOMES:

On completion of the course, students will be able to:

1. Develop algorithmic solutions to simple computational problems.
2. Develop and execute simple Python programs.
3. Write simple Python programs for solving problems.
4. Decompose a Python program into functions.
5. Represent compound data using Python lists, tuples, dictionaries etc.
6. Read and write data from/to files in Python programs.

TEXT BOOK:

1. Reema Thareja, “Python Programming using Problem Solving Approach”, Oxford University Press, 2017.
2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second Edition, Shroff/O‘Reilly Publishers, 2016. (http://greenteapress.com/wp/thinkpython/).

REFERENCES:

1. Guido van Rossum, Fred L. Drake Jr., “An Introduction to Python – Revised and Updated for Python 3.2”, Network Theory Ltd., 2011.
2. John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and Expanded Edition, MIT Press , 2013
3. Charles Dierbach, “Introduction to Computer Science using Python”, Wiley India Edition, 2016.
4. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, Cengage Learning, 2012

EE5251 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LT P C
3 0 0 3

OBJECTIVES:

- To understand the basic concepts of electric circuits, magnetic circuits and wiring.
- To understand the operation of AC and DC machines.
- To understand the working principle of electronic devices and circuits.

UNIT I BASIC CIRCUITS AND DOMESTIC WIRING 9

Electrical circuit elements (R, L and C)-Dependent and independent sources – Ohm's Law-Kirchhoff's laws - mesh current and node voltage methods (Analysis with only independent source) - Phasors – RMS-Average values-sinusoidal steady state response of simple RLC circuits. Types of wiring- Domestic wiring - Specification of Wires-Earthing-Methods-Protective devices.

UNIT II THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS 9

Three phase supply – Star connection – Delta connection –Balanced and Unbalanced Loads-Power in three-phase systems – Comparison of star and delta connections – Advantages-Magnetic circuits-Definitions-MMF, Flux, Reluctance, Magnetic field intensity, Flux density, Fringing, self and mutual inductances-simple problems.

UNIT III ELECTRICAL MACHINES 9

Working principle of DC generator, motor-EMF and Torque equation-Types –Shunt, Series and Compound-Applications. Working principle of transformer-EMF equation-Operating principles of three phase and single phase induction motor-Applications. Working principles of alternator-EMF equation-Operating principles of Synchronous motor, stepper motor-Applications.

UNIT IV BASICS OF ELECTRONICS 9

Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics-Rectifier circuits-Wave shaping.

UNIT V CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES 9

Working principle and characteristics - BJT, SCR, JFET, MOSFET.

TOTAL: 45 PERIODS

OUTCOMES:

CO1 To be able to understand the concepts related with electrical circuits and wiring.
CO2 To be able to study the different three phase connections and the concepts of magnetic circuits.
CO3 Capable of understanding the operating principle of AC and DC machines.
CO4 To be able to understand the working principle of electronic devices such as diode and zener diode.
CO 5 To be able to understand the characteristics and working of current controlled and voltage controlled devices.

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education, 2014
2. Del Toro, "Electrical Engineering Fundamentals", Second edition, Pearson Education, New Delhi, 1989.
3. John Bird, "Electrical Circuit theory and technology", Routledge; 5th edition, 2013

REFERENCES:

1. Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
2. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017
3. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", McGraw Hill, 2010.
4. Muhammad H.Rashid, "Spice for Circuits and electronics", 4th ed.,Cengage India,2019.

GE5152 **ENGINEERING MECHANICS** **LTPC**
3104

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Applying the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Applying the concepts of locating centroids/center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Applying the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Applying the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

UNIT I STATICS OF PARTICLES (9+3)

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNITII EQUILIBRIUM OF RIGID BODIES (9+3)

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNITIII DISTRIBUTED FORCES (9+3)

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies , Determination of Centroids of Volumes by Integration.

Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates , Determination of the Moment of Inertia of a Three-Dimensional Body by Integration

UNIT IV FRICTION (9+3)

The Laws of Dry Friction. Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction. Rolling Resistance, Ladder friction.

UNITV DYNAMICS OF PARTICLES (9+3)

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force , Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact, Method of Virtual Work - Work of a Force, Potential Energy, Potential Energy and Equilibrium.

TOTAL (L: 45 + T: 15)=60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Apply the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Apply the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Apply the concepts of locating centroids / center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Apply the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Apply the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

TEXT BOOKS:

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, SanjeevSanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 11th Edition, 2017.
2. Vela Murali, “Engineering Mechanics-Statics and Dynamics”, Oxford University Press, 2018.

REFERENCES:

1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
5. Timoshenko S, Young D H, Rao J V and Sukumar Pati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.

CY5252 **ORGANIC CHEMISTRY** **L T P C**

3 0 0 3

OBJECTIVES

The course is aimed to

- To learn about oxidation and reduction of organic compounds
- To learn about methods and properties of heterocyclic compounds.
- To learn about preparations and uses of synthetic intermediates.
- To gain the knowledge about synthetic utilities and their preparation.
- To understand therearrangements for organic reaction.

UNIT I OXIDATION AND REDUCTION OF ORGANIC COMPONENTS **9**

Diastereoselective epoxidation of homoallylic alcohols, synthetic reaction of epoxides and ozonolysis, photosensitised oxidation of akenes, oxidation of ketones: conversion into - unsaturated ketones, oxidation of -ketols, oxidative decarboxylation of acids, aromatic rings of phenols, oxidation of amines, aromatization oppenauer oxidation: Reduction by dissolving metals: reduction with metal and acid reduction of carbonyl compounds, reduction with metal in liquid ammonia (Birch reduction) reductive fission of alcohols and halides, reduction by hydride transfer reagents: reduction with borane and dialkylboranes, other methods: Wollff-Kishner reduction, desulphurization of thioacetals, di-imide: WollffKishner reduction, desulphurization of thioacetals, di-imide low-valent titanium species.

UNIT II HETEROCYCLIC COMPOUNDS **9**

Different preparative methods, Physical & Chemical properties (Oxidation, reduction, Electrophilic and nucleophilic) and Uses of Pyrrole, Furan, Furfural, Tetrahydro Furan, Thiophene, Indole, Pyridine, Quinoline and Isoquinoline. Conversion of THF into Nylon 6-6

UNIT III PREPARATION OF SYNTHETIC INTERMEDIATES **9**

Preparations of Benzil from benzyl aldehydes - Furyl from furfural, Vannilin from catechol through guaiacol, Gramine from indole, N-actetyl-5- bromo indoline from indole, Salol from phenol, Alanine from propionic acid, Heteroauxin from indole - Uses, Reaction and mechanism of acyloin condensation, Baeyer-Villigar reaction, Gabriel's synthesis of phthalimide, Bartoli Indole synthesis

UNITIV SYNTHETIC ORGANIC CHEMISTRY **9**

Preparation and Synthetic utilities of Grignard reagent, Ethyl aceto acetate and Malonic ester for higher normal dicarboxylic acids, diketones and cyclic compounds etc.

UNIT V REARRANGEMENTS **9**

Rearrangement to electron deficient carbon: Pinacol-pinacolone, Wagner-Meerwein, Benzillic acid, Wolf (Arndt-Eisterts Synthesis) Rupe and Demjanov rearrangement, Rearrangements electron deficient nitrogen: Hofman, Curtius, Schimdt, Lossen and Beckmann rearrangement, Rearrangement electron deficient oxygen: Baeyer Villiger rearrangement, Rearrangements to electron rich carbon: Fovorskii, Wittig, Neber, Steven's and Sommelet Houser rearrangement Aromatic rearrangements: Fries, Clasisen and Benzidine rearrangement Free radical rearrangements.

TOTAL : 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Understand the oxidation and reduction of organic compounds.

CO2: Obtain the knowledge of Heterocyclic compounds.

CO3: Gain the knowledge about synthetic intermediates.

CO4: Understand the preparations of synthetic utilities.

CO5: Obtain the knowledge about rearrangement reaction.

TEXT BOOKS

1. Robert Thornton Morrison, Robert Neilson Boyd, SaibalKantiBhattacharjee, "Organic Chemistry", Pearson India (2010)
2. "A Textbook of Organic Chemistry", 4th edition by Tewari. K.S and Vishnoi. N.K, Vikas Publishing House Pvt. Ltd. 2017)

REFERENCE BOOKS

1. I L Finar "Organic Chemistry" (2012) – Pearson Publications.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	Understand the oxidation and reduction of organic compounds.	3	-	-	2	-	2	–	–	–	–	1	–		–	2	3
CO2	Obtain the knowledge of Heterocyclic compounds	3	-	-	2	-	2	–	–	–	–	1	–	-	–	2	3
CO3	Gain the knowledge about synthetic intermediates	3	-	-	3	-	2	–	–	–	–	1	–	-	–	2	3
CO4	Understand the preparations of synthetic utilities.	3	3	-	3	-	2	–	–	–	–	1	–	-	–	2	3
CO5	Obtain the knowledge about rearrangement reaction.	3	3	3	2	-	2	–	–	–	–	1	–	-	–	2	3
Overall CO		3	3	3	2	-	2	–	–	–	–	1	–	-	–	2	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

GE5161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY **L T P C**
0 0 4 2

OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To articulate where computing strategies support in providing Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
8. Implementing programs using written modules and Python Standard Libraries.
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

OUTCOMES:

On completion of the course, students will be able to:

- Develop algorithmic solutions to simple computational problems
- Develop and execute simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python data structures.

Apply Python features in developing software applications.

EE5261 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES

1. To impart hands on experience in verification of circuit laws and measurement of circuit parameters
2. To train the students in performing various tests on electrical motors.
3. It also gives practical exposure to the usage of CRO, power sources & function generators

List of Experiments

1. Verification of Kirchhoff's Law.
2. Steady state response of AC and DC circuits (Mesh, Node Analysis)
3. Frequency response of RLC circuits.
4. Measurement power in three phase circuits by two-watt meter method.
5. Regulation of single phase transformer.
6. Performance characteristics of DC shunt generator.
7. Performance characteristics of single phase induction motor.
8. Characteristics of PN diode and Zener diode
9. Characteristics of Zener diode
10. Half wave and full wave Rectifiers
11. Application of Zener diode as shunt regulator.
12. Characteristics of BJT and JFET

TOTAL: 60 PERIODS

OUTCOMES:

1. To become familiar with the basic circuit components and know how to connect them to make a real electrical circuit;
2. Ability to perform speed characteristic of different electrical machines
3. Ability to use logic gates and Flip flop

MA5353 **NUMERICAL METHODS** **L T P C**
4 0 0 4

OBJECTIVES:

- To provide the mathematical foundations of numerical techniques for solving Eigen value problems and linear system of equations.
- To apply the techniques of interpolation for equal and unequal intervals for the given data.
- To understand and to apply the techniques of numerical integration and differentiation for solving and ODE in applying day today life.
- To familiar in solving initial value problems and ODE for given initial and boundary conditions.
- To demonstrate the utility of Numerical techniques for solving Partial Differential Equations in Heat and Fluid problems.

UNIT ISOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton-Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method and by Jacobi's method.

UNIT IIINTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT IIINUMERICAL DIFFERENTATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IVINITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Multi-step methods - Milne's and Adams-Bashforth predictor-corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL:60 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to the algebraic and transcendental equations.
- Apply numerical methods to obtain approximate solutions to mathematical problems using interpolation.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyse and evaluate the accuracy of common numerical methods in solving ODE of First and Second order equations.
- Understand various numerical techniques for solving PDE, for given conditions in Heat flow and Wave problems.

Attested

TEXT BOOKS:

1. Grewal, B.S. and Grewal,J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2014.
2. Sankara Rao . K, "Numerical Methods for Scientists and Engineers", PHI Learning Pvt Ltd., New Delhi, 2007.

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AS5301 INDUSTRIAL STOICHIOMETRY **L T P C**
3 0 0 3

OBJECTIVES

The course is aimed to

- To learn about the basic units, degrees of freedom and unit conversions.
- To formulate and solve material balance in the petrochemical industries.
- To understand the Phase equilibria, Single and Multiple component phase systems.
- To formulate and solve energy balance in the petrochemical industries.
- To understand the unsteady state material and energy balance.

UNIT I **6**

Units, dimensions and conversion; Process variables and properties; Stoichiometric Equations, Degrees of freedom.

UNIT II **11**

Introduction to material balances. Material balance problems for single units; Stoichiometry and Chemical reaction equations; material balance for processes involving reaction bypass, purging, recycle operations.

UNIT III **11**

Ideal gases, Real gases, Single component two phase systems, Multiple component phase systems, Phase rule, Phase equilibria, Combustion processes.

UNIT IV **11**

Energy balances, Conservation of Energy processes without reaction, Heat capacity, Energy balances with chemical reaction, Efficiency applications.

UNIT V **6**

Application of energy balances. Unsteady state material and energy balances. Solving material and energy balances using process simulators.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the concepts of dimensional consistency and effective application of units and dimensions.

CO2: Analyze a problem statement and balance the material flowing through single and various operations.

CO3: Understand the gas behavior and its properties and vapor-liquid pattern

CO4: Understand general energy balance, simplify and apply to open and closed systems

CO5: Write material and energy balance for unsteady state how material and energy balances are formulated for equation- and modular based flow sheeting codes

TEXT BOOKS:

1. Himmelblau, D.M., James B.Riggs “Basic Principles and Calculations in Chemical Engineering”, eight edition, Prentice Hall Inc., 2012
2. Felder, R. M. and Rousseau, R. W., Lisa G.Bullard “Elementary Principles of Chemical Processes”,4th Edn., John Wiley , 2015
3. Bhatt, B.L., Vora, S.M., “Stoichiometry “, 4th Edition,Tata McGraw-Hill (2004)

Attested

REFERENCES:

1. Hougen O A, Watson K M and Ragatz R A, “Chemical process principles” Part I, CBS publishers (2004).

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the concepts of dimensional consistency and effective application of units and dimensions.	3	2	2	2	-	3	3	–	–	–	3	–	3	–	2	3
CO2	Analyze a problem statement and balance the material flowing through single and various operations.	2	3	3	2	-	2	-	–	–	–	-	–	-	2	3	-
CO3	Understand the gas behavior and its properties and vapor-liquid pattern	3	-	2	3	-	2	3	–	–	–	-	–	3	3	-	-
CO4	Understand general energy balance, simplify and apply to open and closed systems	3	2	3	-	-	-	3	–	–	–	2	–	-	3	-	3
CO5	Write material and energy balance for unsteady state how material and energy balances are formulated for equation- and modular based flow sheeting codes	-	3	3	3	-	-	–	–	–	–	3	–	-	3	3	-
Overall CO		3	3	3	3	-	2	3	–	–	–	3	–	3	3	3	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5302 FLUIDS AND SOLID OPERATIONSL T P C
3 0 0 3

OBJECTIVES

The course is aimed to

- To learn classifications of fluids and their properties.
- To study about flow of fluid in pipeline and their boundary conditions.
- To analyze the size of various materials and laws of crushing and grinding.
- To learn about flow regime of fluid in fluidized and packed bed.
- To study about techniques of solid – fluid separation.

UNIT I PROPERTIES OF FLUID 9

Newtonian fluids Classification of fluid motion Fluid statics – equilibrium of fluid element – pressure variation in a static fluid – Differential analysis of fluid motion – continuity, Euler's and Bernoulli equation

UNIT II FLOW THROUGH PIPES & BOUNDARY LAYER CONCEPTS 9

Reynolds number regimes, Flow through pipes – pressure drop under laminar and turbulent flow conditions; boundary layer concepts; different types of flowmeters; Valves, pumps, compressors – characteristics and sizing; Agitation and Mixing;

UNIT III SIZE ANALYSIS 9

General characteristics of solids, techniques of size analysis; Laws of size reduction, equipments for size reduction

UNIT IV FLOW THROUGH FLUIDIZED BEDS 9

Flow over a sphere – friction and pressure drag - flow through fixed and fluidized beds. Filtration – batch and continuous, filtration equipment - selection, operation

UNIT V CLASSIFIERS 9

Screening, gravity separation - sedimentation, thickening, elutriation, classifiers - Centrifugal separation - continuous centrifuges, cyclones and hydro cyclones, electrostatic and magnetic separators

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the fundamental properties of fluids, stress-strain relationship in fluids, and its characteristics under static conditions and establish force balance in static systems.

CO2: Students will be able to apply Bernoulli's principle, Navier – Stokes' equation and compute pressure variation in static fluid.

CO3: Obtain the knowledge about the size reduction techniques.

CO4: Understand about the fluidized bed, flows of fluids in their beds.

CO5: Understand various separation and purification techniques employed in solid particles.

TEXT BOOKS:

1. Noel de Nevers, "Fluid Mechanics for Chemical Engineers ", Second Edition, McGraw-Hill, 3rd Edition (2004).
2. S. Pushpavanam, "Introduction to Chemical Engineering", PHI learning private limited, 2012

REFERENCES:

1. Munson, B. R., Young, D.F., Okiishi, T.H. "Fundamentals of Fluid Mechanics", 6thEdition", John Wiley, 2009
2. McCabe W.L, Smith, J C and Harriot. P "Unit operations in Chemical Engineering", 7th edition, McGraw Hill, V Edition, 2004
3. Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. I, 7th Edn., Butterworth-Heinemmann, Elsevier, 2017.

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the fundamental properties of fluids, stress-strain relationshipin fluids,and itscharacteristics under static conditions and establish force balance in static systems.	3	3	3	-	-	-	2	–	1	–	2	–	-	3	3	-
CO2	Students will be able to apply Bernoulli's principle, Navier – Stokes' equation and compute pressure variation in static fluid.	3	2	3	3	-	-	-	–	–	–	-	2	-	2	3	-
CO3	Obtain the knowledge about the size reduction techniques.	3	2	2	3	-	1	1	–	–	–	-	–	3	-	-	3
CO4	Understand about the fluidized bed, flows of fluids in their beds.	3	-	3	-	3	-	2	–	–	–	2	2	-	3	-	3
CO5	Understand various separation and purification techniques employed in solid particles.	-	-	3	2	3	-	3	–	1	–	1	–	3	-	-	3
Overall CO		3	2	3	3	3	1	2	–	1	–	2	2	3	3	3	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5303 PETROLEUM GEOLOGY AND GEOPHYSICS **L T P C**

3 0 0 3

OBJECTIVE

The course is aimed to

- To analyse the origin and the types of rocks.
- To study about reservoir geometry and traps.
- To learn about the sedimentology and their types.
- To learn about exploration and geophysical methods.
- To analyse the deep study of logging equipment.

UNIT I **9**

Earth Science – Origin of Earth. Nature and properties of minerals and rocks. Classification of Igneous, Sedimentary and Metamorphic rocks- Sedimentation and sedimentary environment. Identification of rocks in the field, Techniques adopted. Introduction to Plate Tectonics process.

UNIT II **9**

Structural Geology – Geometric classification of folds, faults and joints, unconformity, outcrops-topography– Petroleum Traps definition and types-Identification of structural and stratigraphic traps in the field and in geological section (surface and subsurface).

UNIT III **9**

Sedimentary basins – types and classification of sedimentary basins- introduction to stratigraphy-types (Litho, Bio, Chrono) -geological time scale. Sedimentology of petroleum bearing sequences, generation and migration of petroleum- Reservoir rock, cap rock, source rock.

UNIT IV **9**

Elements of geological, geophysical and geochemical methods of exploration. Geophysics as a tool for mapping of subsurface geological features, Geophysical methods - Gravity, Magnetic, electromagnetic.

UNIT V **9**

Seismic Wave theory - reflection and refraction and their use in data acquisition, Land and Marine geophysical methods. Electrical methods - Earth resistivity, SP, Induced Polarization. Electrical mapping and anisotropic earth and logging- Reservoir Evaluation- 3D interpretation (Structural mapping stratigraphic interpretation) - 4D reservoir characterization.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the rock types and their birth place.

CO2: Gain the knowledge about reservoir geometry.

CO3: Obtain the concepts of sedimentary rocks and their classifications.

CO4: Understand the concepts of exploration methods and method to analyze their features.

CO5: Obtain the techniques and theories of seismic instruments.

TEXT BOOKS:

1. Cox, P.A., “The Elements on Earth”, Oxford University Press, Oxford 1995.
2. Wilson, M., “Igneous Petrogenesis”, Unwin Hyman, London 1989.

REFERENCE:

1. Petroleum geology, William Russel and A I Leverson
2. Textbook of Petroleum Geology by B G Deshpande.
3. Elements of Petroleum Geology By Richard C Selley
4. Non-Technical Guide to Petroleum Geology Exploration, Drilling and Production by Narman J Hyne.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the rock types and their birth place	3	-	-	-	-	2	2	–	2	1	-	3	-	3	-	3
CO2	Gain the knowledge about reservoir geometry.	3	-	-	-	-	3	3	–	2	–	2	2	3	3	-	-
CO3	Obtain the concepts of sedimentary rocks and their classifications.	3	-	-	3	-	3	3	–	–	–	2	-	3	3	-	3
CO4	Understand the concepts of exploration methods and method to analyze their features.	-	-	3	3	3	3	3	–	–	–	2	-	-	3	-	-
CO5	Obtain the techniques and theories of seismic instruments.	3	-	3	2	3	3	2	–	-	–	-	–	3	-	-	-
Overall CO		3	-	3	3	3	3	3	–	2	1	2	3	3	3	-	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5304 RESERVOIR ENGINEERING

L T P C
3 0 0 3

OBJECTIVES

The course is aimed to

- To analyse the properties of reservoir fluids and their classification.
- To study about the fundamentals reservoir rock properties.
- To determine the fundamentals of fluid flow in reservoir.
- To learn about the fluid recovery system in reservoir by their material balance equation.
- To study about the reservoir fluid coning and their techniques.

UNIT I FUNDAMENTALS OF RESERVOIR AND RESERVOIR FLUIDS 9

Classification of Reservoirs and Reservoir Fluids - Properties of Natural Gases - Behaviour of Ideal Gases - Behaviour of Real Gases - Properties of Crude Oil Systems - Properties of Reservoir Water.

UNIT II FUNDAMENTALS OF ROCK PROPERTIES 9

Porosity – Saturation – Wettability - Surface and Interfacial Tension - Capillary Pressure – Permeability and Relative Permeability Concepts - Rock Compressibility - Net Pay Thickness - Reservoir Heterogeneity - Areal Heterogeneity.

UNIT III FUNDAMENTALS OF RESERVOIR FLUID FLOW 9

Types of Fluids - Flow Regimes - Reservoir Geometry - Fluid Flow Equations - Steady-State Flow – Unsteady State Flow - Constant-Terminal-Pressure Solution - Constant-Terminal-Rate Solution - Horizontal and Vertical Oil Well Performance and Horizontal and Vertical Gas Well Performance.

UNIT IV RECOVERY MECHANISM AND MATERIAL BALANCE EQUATION 9

Oil Reservoirs - Primary Recovery Mechanism - Material Balance Equation – Reservoir Performance prediction Methods and Relating Reservoir Performance to Time. Gas Reservoirs - Volumetric Method and the Material Balance Equations as a Straight Line.

UNIT V CONING AND DECLINE CURVE 9

Gas and Water Coning – Decline Curve Analysis (Exponential, Harmonic, Hyperbolic)-Vapor-Liquid Phase Equilibria – Well Testing Concepts (Pressure Transient Tests).

TOTAL: 45 PERIODS.

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Gain the knowledge about the reservoir fluids and their properties.

CO2: Obtain the knowledge of rocks present over the reservoir.

CO3: Understand the mathematical relationships that are designed to describe the flow behaviour of the reservoir fluids.

CO4: Understand the concepts of the oil/gas recovery techniques.

CO5: Gain the knowledge about the coning in reservoir and their techniques.

TEXTBOOKS:

1. Ahmed, T, “Reservoir Engineering Handbook”, 4th Edition (2010).

REFERENCES:

1. Hydrocarbon Phase Behaviour by Tarek Ahmed.
2. The practice of Reservoir Engineering: Volume 36 by L P Dake (2001).

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Gain the knowledge about the reservoir fluids and their properties.	3	-	-	-	2	2	3	–	-	-	2	-	3	-	-	3
CO2	Obtain the knowledge of rocks present over the reservoir.	3	2	2	3	-	3	3	–	1	-	-	-	-	3	-	-
CO3	Understand the mathematical relationships that are designed to describe the flow behavior of the reservoir fluids.	-	3	3	3	3	2	1	–	–	-	-	-	-	3	3	3
CO4	Understand the concepts of the oil/gas recovery techniques.	3	-	-	-	-	2	3	2	–	-	-	-	3	3	-	2
CO5	Gain the knowledge about the coning in reservoir and their techniques.	3	-	3	3	3	2	3	–	2	–	-	1	3	-	-	3
Overall CO		3	3	3	3	3	2	3	2	2	-	2	1	3	3	3	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5311 **FLUIDS AND SOLID OPERATIONS LABORATORY**

L T P C
0 0 4 2

OBJECTIVES

The course is aimed to

- To learn experimentally to calibrate flow meters
- To find pressure loss for fluid flow in pipes
- To determine pump characteristics.
- To learn about fluidization
- To develop a sound working knowledge on different types of crushing equipments and separation characteristics of different mechanical operation separators.

LIST OF EXPERIMENTS - Phase - I

1. Calibration of constant and variable head meters
2. Open drum orifice and draining time
3. Flow through straight pipe
4. Flow through annular pipe
5. Flow through helical coil and spiral coil
6. Characteristic curves of pumps
7. Pressure drop studies in packed column

EQUIPMENT REQUIRED

1. Venturi meter
2. Orifice meter
3. Rotameter
4. Weir
5. Open drum with orifice
6. Pipes and fittings
7. Helical and spiral coils
8. Centrifugal pump
9. Packed column
10. Fluidized bed

LIST OF EXPERIMENTS - Phase- II

1. Sieve analysis
2. Batch filtration studies using a Leaf filter
3. Batch filtration studies using a Plate and Frame Filter press
4. Characteristics of batch Sedimentation
5. Reduction ratio in Jaw Crusher
6. Reduction ratio in Ball mill
7. Separation characteristics of Cyclone separator
8. Reduction ratio of Roll Crusher

TOTAL: 60 PERIODS

Attested

COURSE OUTCOME:

On completion of the course students are expected to

CO1: Use variable area flow meters and variable head flow meters

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CO2: Analyze the flow of fluids through closed conduits, open channels and flow past immersed bodies Select pumps for the transportation of fluids based on process conditions/requirements and fluid properties.

CO3: Determine work index, average particle size through experiments by crushers, ball mill and conducting sieve analysis.

CO4: Design size separation equipment such as cyclone separator, sedimentation, Filters etc.

CO5: Able to study the flow through fluidized bed.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Use variable area flow meters and variable head flow meters.	3	-	3	3	-	3	3	–	2	-	2	-	3	-	-	3
CO2	Analyze the flow of fluids through closed conduits, open channels and flow past immersed bodies Select pumps for the transportation of fluids based on process conditions/ requirements and fluid properties.	-	3	3	-	-	-	2	–	-	2	2	1	-	3	3	-
CO3	Determine work index, average particle size through experiments by crushers, ball mill and conducting sieve analysis.	-	-	3	3	-	3	3	–	2	-	2	1	-	3	3	-
CO4	Design size separation equipment such as cyclone separator, sedimentation, Filters etc.	3	-	3	3	3	2	2	-	–	-	1	-	-	-	3	3
CO5	Able to study the flow through fluidized bed.	-	-	3	3	3	2	3	–	2	–	1	-	3	-	3	-
Overall CO		3	3	3	3	3	3	3	-	2	2	2	1	3	3	3	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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CY5361 ORGANIC CHEMISTRY LABORATORY LT P C
0 0 4 2

OBJECTIVES

The course is aimed to

- To learn basic principles involved in analysis and synthesis of different organic derivatives.
- To identify the functional groups
- To know the separation of organic mixtures
- To prepare simple organic compounds
- To study the preparation of dyes

LIST OF EXPERIMENTS

1. Identification and characterization of various functional groups by their characteristic reactions: a) alcohol, b) aldehyde, c) ketone, d) carboxylic acid, e) phenol f) primary, secondary and tertiary amines
2. preparation of solid derivatives: a) 2,4 tri nitro phenyl hydrazone for aldehydes and ketones, b) acetyl and benzoyl derivatives for amine and phenol c) diazotization of aromatic amine
3. Preparation of Methyl red and Fluorescein
4. Separation of organic mixtures: a) aldehyde and acid, b) amine and phenol
5. Recrystallization of benzoic acid and acetanilide
6. Preparation of simple organic compounds like a) Naphthalene – Nitro naphthalene – 4 nitro – 1 – amino naphthalene b) Benzene – Benzil – benzylic acid.
7. Detection of peroxide in ether and its removal

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Conduct simple experiments to identify the functional group

CO2: Prepare derivatives for aldehydes, ketones, sugars, amine and phenol

CO3: Analyzing various procedure to separate organic mixtures

CO4:Steps to carry out recrystallization

CO5:Preparation of synthetic organic compounds like

a) Naphthalene – Nitro naphthalene – 4 nitro – 1 – amino naphthalene

b) Benzene – Benzil – benzylic acid.

REFERENCE:

1. Practical organic chemistry, S.P. Bhutani, Ane books. 2009
2. Practical chemistry, V K Ahluwalia, University press. 2011
3. Text book of practical organic chemistry. Brain S Furniss, Pearson education 2011
4. Practical Organic Chemistry by Dey and Raman
5. Laboratory Manual of Organic Synthesis by M.N.Khramkina MIR publishers Moscow, First published in 1980, revised editions once in every five year. Last revised edition 2010.
6. Practical Chemistry by Balwant Rai Satija, Allied Publishers Pvt Ltd 1988.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	Conduct simple experiments to identify the functional group.	-	-	-	3	3	3	2	-	2	-	1	-	-	3	3	-
CO2	Prepare derivatives for aldehydes, ketones, sugars, amine and phenol	3	-	3	-	-	2	2	-	-	1	1	-	3	-	-	-
CO3	Analyzing various procedure to separate organic mixtures	-	3	3	3	-	1	-	–	2	-	-	-	-	3	3	2
CO4	Steps to carry out recrystallization	-	-	3	3	3	-	-	-	2	1	-	-	3	-	-	-
CO5	Preparation of synthetic organic compounds like a) Naphthalene – Nitro naphthalene – 4 nitro – 1 – amino naphthalene b) Benzene – Benzil – benzylic acid.	3	-	3	3	-	2	2	-	1	–	1	-	3	-	3	-
Overall CO		3	3	3	3	3	3	2	-	2	1	1	-	3	3	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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GE5451 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9

Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation-Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.

Attested

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Ability to apply TQM concepts in a selected enterprise.
CO2: Ability to apply TQM principles in a selected enterprise.
CO3: Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.

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CO4: Ability to understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
CO5: Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Bester field,MaryB.Sacre,HemantUrdhwareshe and RashmiUrdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. Joel.E. Ross, "Total Quality Management – Text and Cases",Routledge.,2017.
2. Kiran.D.R, "Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.
3. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
4. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006 .

GE5251 ENVIRONMENTAL SCIENCES L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- To inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and environmental issues.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land 47 degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
- To identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.
- To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
- To recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.
- To demonstrate the knowledge of societal activity on the long and short term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

Attested

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "*Perspectives in Environmental Studies", 6th Edition,* New Age International Publishers (2018).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2016).

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3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).

REFERENCE BOOKS:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005).
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. (2013).

AS5401 DRILLING OPERATIONS L T P C

300 3

OBJECTIVES.

The course is aimed to

- To learn about drill rigs and their types.
- To study about the drilling components and systems.
- To analyze the methods and techniques while drilling.
- To study about the rheology, drill bit and mud classification.
- To analyze about the drill rig problems and prevention techniques.

UNIT I **9**

Drilling operations – Location to Rig. Release Well Bore Diagram, Crews – Operator – Drilling, contractor – Third Party Services – Rig Types – Land Types – Marine types

UNIT II **9**

Components- Overall Drilling Rig, Drilling Sub systems – Power – Hoisting Line – speeds and Loads Power – Loading Components – Drill Pipe, Heavy Weight Drill Pipe (HWDP), Drill String Loads Uniaxial.

UNIT III **9**

Directional Drilling, Well Planning, Two Dimensional, Horizontal, Tools, Techniques, MWD, surveying – Radius of Curvature, Long's Method – Errors, Muds, Mud Use, Property measurements, Types, - Pneumatic (Air, Gas, Mist, Foam), Water based, Oil based, solids Control, Definitions, Equipment, Problems, Contaminations Effect.

UNIT IV **9**

Hydraulics, Classifications of Fluids, Rheological Models – Rotary Drilling Hydraulics – Jet Hydraulic Optimizing and Maximizing – Circulations Rate Selection – Drill Bit – Jet Sizing – Equivalent Circulations Density, Hole Cleaning. Theory – Vertical and Deviated Holes, Annular Velocities – Carrying Capacity – Pills and Slugs.

UNIT V **9**

Origin of Overpressure, Kick Signs, shut –in Procedures, Kill sheets, Kill Procedures, Driller's Methods – Engineer's Method (Wait and Weight)

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Understand the concepts of rig crews and rig types.

CO2: Obtain the concepts of on-site drill systems and components while using.

CO3: Gain knowledge of drilling techniques and deep study of drill mud.

CO4: Understand the concepts of hydraulic techniques and hole cleaning criteria

CO5: Obtain the knowledge about rig accidents and their risks.

TEXT BOOKS

1. Rabia.H. 'Oil Well Drilling Engineering, Principles and Practices' Graham and Trotman Ltd. 1985.
2. Rober F. Mitchell, Stefan Z. miska, "Fundamentals of Drilling engineering:, Society of Petroleum Engineers (2001).
3. "Standard Handbook of Petroluem and Natural Gas Engineering, 5th Edition, William C Lyons, Gary C Pilisga, Gulf Professional Publishing, 2015.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the concepts of rig crews and rig types.	3	-	3	-	3	3	2	-	2	1	1	-	3	2	2	-
CO2	Obtain the concepts of on-site drill systems and components while using.	-	-	3	3	-	2	2	-	-	-	-	-	-	3	3	-
CO3	Gain knowledge of drilling techniques and deep study of drill mud.	3	-	3	3	3	3	-	–	-	-	-	-	3	-	3	3
CO4	Understand the concepts of hydraulic techniques and hole cleaning criteria	-	-	3	3	3	2	2	-	-	-	1	-	-	3	3	-
CO5	Obtain the knowledge about rig accidents and their risks.	3	3	-	2	-	2	2	3	2	–	-	-	3	-	3	3
Overall CO		3	3	3	3	3	3	2	3	2	1	1	-	3	3	3	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5402 PETROLEUM REFINING AND PETROCHEMICALS L T P C
3 0 0 3

OBJECTIVES

The course is aimed to

- To study about the fundamentals refining units and their components.
- To understand the different sulphur removal techniques and desalting of crudes.
- To learn about the catalytic process takes place in the refineries.
- To study about the various reaction mechanisms that takes place in refinery.
- To learn about the production techniques of the various petrochemical products.

UNIT I **7**

Exploration and Refining of Crude Oil: Introduction, Indian and world reserve of crude oil and its processing capacity, Market demand & supply of petroleum Fractions, engineering data of crude and fractions. Characterization factor, Key Fraction Number and correlation index methods for evaluation of crude & fractions. TBP, ASTM, EFV, and their inter-convertibility, yield Curve etc.

UNIT II **9**

Desalting of crude, Atmospheric and vacuum distillation units, different types of Reflux arrangements, Test methods and specifications, Different Hydro treatment (Hydro desulfurization processes, Merox process, Doctor's sweetening, DHDS, Claus process, Amine treatment)

UNIT III **11**

Thermal conversion Processes: Thermal cracking processes-visbreaking, thermal cracking, coking operations. Catalytic Conversion Processes: Catalytic cracking processes, Different FCC operating modes, Catalytic reforming operations, Hydrocracking, Naphtha cracking, Polymerization- Thermal, catalytic. Isomerization processes

UNIT IV **11**

Steam reforming, Hydrogen, Synthesis gas, cracking of gaseous and liquid for stocks, Olefins, Diolefins, Acetylene and Aromatics and their separation, Alkylation, Oxidation, Dehydrogenation, Nitration, Chlorination, Sulphonation and Isomerization

UNIT V **7**

Modes and techniques, Production of Polyethylene, PVC, Polypropylene, SAN, ABS, SBR, Polyacrylonitrile, Polycarbonates, Polyurethane, Nylon, PET

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Establish the crude oil and their techniques economically.

CO2. Know the sulphur removal techniques and their causes.

CO3. Understand the concepts about catalytic refining units.

CO4. Get conversant with the various process for the production of petrochemicals.

CO5: Obtain petrochemical products from various refinery units.

TEXT BOOKS:

1. J.H. Gary et al, "Petroleum Refining", CRS press, New York, 5th ed., 2007, 6th edition, 2019
2. B.K. Bhaskara Rao, "Modern Petroleum Refining Processes", Oxford & IBH Publishing Co. Pvt. Ltd., 5th ed., 2008
3. Bhaskara Rao, B. K. "A Text on Petrochemicals", 5th Edn., Khanna Publishers, New Delhi, 2004

REFERENCES:

1. Kayode Coker, A., "Petroleum Refinery Engineering Design and Applications", John Wiley Publishing Company Limited, 2018.
2. Kiran Pashikanti, Ai-Fu Chang., "Refinery Engineering: Integrated process modeling and optimization", Wiley-VCH, 2012
3. Gopal Rao, M., "Dryden's Outlines of Chemical Technology for the 21st century", 3rd edn, Affiliated East-West press, Pvt.Ltd-New Delhi, 2006
4. George T. Austin, Shreve's Chemical Process Industries, McGraw Hill Education, 2017

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Establish the crude oil and their techniques economically.	3	-	-	-	3	-	-	-	-	-	-	-	3	-	2	-
CO2	Know the sulphur removal techniques and their causes.	-	3	-	3	2	-	3	-	-	-	-	-	-	2	3	-
CO3	Understand the concepts about catalytic refining units.	3	-	3	2	-	-	-	–	-	-	-	-	3	3	-	-
CO4	Get conversant with the various process for the production of petrochemicals.	-	-	-	3	3	-	-	-	-	-	-	-	3	-	2	-
CO5	Obtain petrochemical products from various refinery units.	-	-	3	2	3	-	3	-	-	–	-	-	3	-	3	-
Overall CO		3	3	3	3	3	-	3	-	-	-	-	-	3	3	3	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

Attested

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AS5403 **PROCESS HEAT TRANSFER**

L T P C
3 0 0 3

OBJECTIVE:

The course is aimed to

- To study about the fundamentals of heat transfer.
- To analyze about the modes of heat transfer and their co-efficient.
- To study about the various heat transfer empirical relations for different applications.
- To learn about the deep study of heat transfer through radiation
- To understand the concepts of various parameter scale and their techniques.

UNIT I **9**

Importance of heat transfer in Chemical Engineering operations - Modes of heat transfer - Fourier's law of heat conduction - one dimensional steady state heat conduction equation for flat plate, hollow cylinder, - Heat conduction through a series of resistances - Thermal conductivity measurement; effect of temperature on thermal conductivity; Heat transfer in extended surfaces.

UNIT II **9**

Concepts of heat transfer by convection - Natural and forced convection, analogies between transfer of momentum and heat - Reynold's analogy, Prandtl and Coulburn analogy. Dimensional analysis in heat transfer, heat transfer coefficient for flow through a pipe, flow past flat plate, flow through packed beds.

UNIT III **9**

Heat transfer to fluids with phase change - heat transfer from condensing vapours, drop wise and film wise condensation, Nusselt equation for vertical and horizontal tubes, condensation of superheated vapours, Heat transfer to boiling liquids - mechanism of boiling, nucleate boiling and film boiling.

UNIT IV **9**

Theory of evaporation - single effect and multiple effect evaporation - Design calculation for single and multiple effect evaporation. Radiation heat transfer - Black body radiation, Emissivity, Stefan - Boltzmann law, Plank's law, radiation between surfaces.

UNIT V **9**

Log mean temperature difference - Single pass and multipass heat exchangers; plate heat exchangers; use of correction factor charts; heat exchangers effectiveness; number of transfer unit - Chart for different configurations - Fouling factors

TOTAL : 45 PERIODS

COURSE OUTCOMES

Attested

On completion of the course students are expected to

CO1: To familiarize the students with the fundamental concepts of Heat Transfer. provide the student with knowledge about heat transfer by conduction in solids for steady state.

CO2: Students will understand convective heat transfer and use of heat transfer coefficients for laminar and turbulent flows

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CO3: Students will be able to calculate and use overall heat transfer coefficients in designing heat exchangers

CO4: The course provides the student with knowledge about heat transfer with phase change (boiling and condensation) and evaporation.

CO5: Students will understand radiative heat transfer including blackbody radiation and Kirchhoff's law, and will be able to solve radiative problems apply knowledge of heat transfer to solve thermal engineering problems

TEXT BOOKS:

1. Holman, J. P., 'Heat Transfer ', 10th Edn., McGraw Hill, 2009.
2. Ozisik, M. N., "Heat Transfer: A Basic Approach", McGraw-Hill, 1984
3. Kern, D.Q., "Process Heat Transfer ", Echo point books and Media, United states, 2017.

REFERENCES:

1. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edn., McGraw-Hill, 2004.
2. Coulson, J.M. and Richardson, J.F., "Chemical Engineering "Vol. I, 7th Edn, Butterwoth-Heinemmann, 2013.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	To familiarize the students with the fundamental concepts of Heat Transfer. provide the student with knowledge about heat transfer by conduction in solids for steady state.	3	2	-	-	2	-	-	-	-	-	-	2	3	-	-	3
CO2	Students will understand convective heat transfer and use of heat transfer coefficients for laminar and turbulent flows	3	2	2	-		-	-	-	-	-	-	-	2	-	-	2
CO3	Students will be able to calculate and use overall heat transfer coefficients in designing heat exchangers.	-	3	2	3	3	-	-	–	-	-	-	-	2	-	-	-
CO4	The course provides the student with knowledge about heat transfer with phase change (boiling and condensation) and evaporation	-	3	2	3	3	-	-	-	-	-	-	-	3	-	-	-
CO5	Students will understand radiative heat transfer	3	-	2	-	2	-	-	-	-	–	-	-	2	-	-	-

	including blackbody radiation and Kirchhoff's law, and will be able to solve radiative problems apply knowledge of heat transfer to solve thermal engineering problems																
Overall CO		3	3	2	3	3	-	-	-	-	-	-	2	2	-	-	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

AS5404 CHEMICAL ENGINEERING THERMODYNAMICS L T P C

3 1 0 4

OBJECTIVE:

The course is aimed to

- To study the basic laws of thermodynamics and charts.
- To learn about the first and second law applications in thermodynamics.
- To understand the concepts of various cycles and equilibrium conditions in thermodynamics.
- To learn about pure component properties by the way of various scientific equation.
- To study about phase equilibria and intensive properties in deep manner.

UNIT I ZEROTH AND FIRST LAWS, PROPERTIES OF PURE SUBSTANCES 9

Definitions and Concepts. Property, Thermodynamic State. Equilibrium, Energy, Work. Zeroth Law of Thermodynamics, Temperature Scale. Pure substance, Phase, Simple compressible substance, Ideal gas Equation of State, Law of corresponding states, Compressibility chart, Pressure –Volume and Temperature-volume Phase diagrams. Mollier diagram. First Law of Thermodynamics and its consequences.

UNIT II APPLICATION OF I LAW TO STEADY - STATE PROCESSES, II LAW 9

Application of I Law of Thermodynamics for Flow Process. Steady-state processes. II Law of Thermodynamics and its Applications: Limitations of the I Law of Thermodynamics, Heat Engine, Heat Pump/Refrigerator. II Law of Thermodynamics – Kelvin Planck and Clausius statements. Reversible and irreversible processes, Criterion of reversibility, Carnot cycle and Carnot principles, Thermodynamic Temperature scale, Clausius inequality, Entropy.

UNIT III POWER CYCLES, THERMODYNAMIC POTENTIALS, EQUILIBRIA AND STABILITY 9

Power and Refrigeration Cycles. Thermodynamic Potentials. Maxwell relations. Thermodynamic relations. Equilibria and stability. Maxwell construction, Gibbs Phase Rule. Clapeyron equation and vapor pressure correlations.

UNIT IV PROPERTIES OF PURE COMPONENTS AND MIXTURES 9

Pure component properties: Equation of state. Ideal gas heat capacities, fundamental equations from experimental data, fugacity and corresponding states. Mixture Properties: Mixing function. Gibbs-Duhem relation for mixtures, partial molar quantities. Ideal gas mixtures and fugacities, ideal mixtures and activities, excess functions. Gibbs free energy models, infinite dilution properties. Henry's Law

UNIT V PHASE EQUILIBRIA AND CHEMICAL REACTION EQUILIBRIA 9

Phase Equilibria of Mixtures. Osmotic pressure and Osmotic coefficients. Boiling point elevation and freezing point depression. Chemical Reaction Equilibria. Reaction extent and Independent reactions. Equilibrium criteria and equilibrium constant. Standard enthalpies and Gibbs free energy, temperature and pressure effects on reactions, heterogeneous reaction, multiple chemical reactions

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the fundamental concepts of thermodynamics and its related functions

CO2: Relate PVT behavior of fluids and understand the real gas behavior

CO3: Apply second law and analyze the feasibility of system/devices

CO4: Analyze the thermodynamic property relations and their application to fluid flow

CO5: Develop the significance of thermodynamic potentials and their use in the analysis of processes

TEXT BOOKS:

1. Sonntag, Borgnakke. C., "Fundamentals of Thermodynamics", 9th Edition, Wiley India, 2016.
2. Smith, van Ness and Abbott, Swihart., "Chemical Engineering Thermodynamics", 8thEdition, McGraw Hill, 2017

REFERENCES:

1. S. I. Sandler, Chemical, Biochemical and Engineering Thermodynamics, 5th edition, Wiley, 2017
2. Narayanan K.V., "A textbook of Chemical Engineering Thermodynamics", 2nd edition, PHI Learning Pvt.Ltd, 2013
3. Pradeep Ahuja," Chemical Engineering Thermodynamics", PHI Learning Ltd (2009).
4. Gopinath Halder," Introduction to Chemical Engineering Thermodynamics", 2nd edition, PHI Learning Ltd, 2014

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the fundamental concepts of thermodynamics and its related functions.	3	2	3	2	2	-	-	-	-	-	-	-	3	3	2	-
CO2	Relate PVT behavior of fluids and understand the real gas behavior	-	3	2	3	3	-	-	-	-	-	-	-	2	2	-	-
CO3	Apply second law and analyze the feasibility of system/devices	3	-	-	-	2	-	-	–	-	-	-	-	2	-	-	-
CO4	Analyze the thermodynamic property relations and their application to fluid flow.	3	-	-	2	3	-	2	-	-	-	-	-	3	-	-	2

CO5	Develop the significance of thermodynamic potentials and their use in the analysis of processes	3	-	3	2	2	-	-	-	-	–	-	-	3	-	-	2
Overall CO		3	3	3	2	2	-	2	-	-	-	-	-	3	3	2	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

AS5413 PROCESS HEAT TRANSFER LABORATORY L T P C
0 0 4 2

OBJECTIVES

The course is aimed to

- To learn the basic principles involved in heat transfer equipment
- To apply the concepts of heat transfer and fluid dynamics to the unit operations
- To know about the use of fins in heat exchangers
- To estimate heat transfer coefficients and rates
- To study the performance of heat transfer equipment

LIST OF EXPERIMENTS*

1. Performance studies on Cooling Tower
2. Batch drying kinetics using Tray Dryer
3. Heat transfer in Open Pan Evaporator
4. Boiling Heat Transfer
5. Heat Transfer through Packed Bed
6. Heat Transfer in a Double Pipe Heat Exchanger
7. Heat Transfer in a Bare and Finned Tube Heat Exchanger
8. Heat Transfer in a Condenser
9. Heat Transfer in Helical Coils
10. Heat Transfer in Agitated Vessels

EQUIPMENT REQUIRED

1. Cooling Tower
2. Tray Dryer
3. Open Pan Evaporator
4. Boiler
5. Packed Bed
6. Double Pipe Heat Exchanger
7. Bare and Finned Tube Heat Exchanger
8. Condenser
9. Helical Coil
10. Agitated Vessel

*Minimum 10 experiments shall be offered

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Apply the concepts of heat transfer and fluid dynamics to the operation of heat transfer equipment.

CO2: Estimate the heat transfer rate and heat transfer co-efficient

CO3: To perform heat transfer operation and to compare observed with predicted performance.

CO4: Evaluate the performance/calculate the parameters in heat transfer equipment.

CO5: Collect and analyse the heat transfer data practically.

CO6: Conduct experiments to solve complex engineering problems effectively as an individual as well as team work.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Apply the concepts of heat transfer and fluid dynamics to the operation of heat transfer equipment.	3	3	-	2	2	2	-	-	3	3	-	-	3	-	-	2
CO2	Estimate the heat transfer rate and heat transfer co-efficient	-	3	2	3	2	3	-	-	2	2	-	-	2	-	-	-
CO3	To perform heat transfer operation and to compare observed with predicted performance.	3	2	-	2	2	2	-	–	3	2	-	-	-	-	2	2
CO4	Evaluate the performance/calculate the parameters in heat transfer equipment.	-	2	3	3	3	2	2	-	3	3	-	-	-	-	3	2
CO5	Collect and analyse the heat transfer data practically.	-	3	2	3	-	-	-	-	3	3	-	-	3	-	2	-
Overall CO		3	3	2	3	2	2	2	-	3	3	-	-	3	-	2	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

AS5412 PETROLEUM GEOLOGY AND GEOPHYSICS LABORATORY **L T P C**
0 0 2 1

OBJECTIVES

The course is aimed to

- To demonstrate various methods involved in the preparation of structural maps and interpretation
- To calculate the thickness of the beds,
- To study depositional environment using grain size analysis
- To find out sediment types using Sand – Silt – Clay ratio.
- To learn about surveying techniques

LIST OF EXPERIMENTS

1. Calculation of true and apparent dip.
2. Estimation of thickness, distance and depth of over body.
3. Estimation of throw and nature of fault.
4. Interpretation of surface geology using contours.
5. Grain size analysis.
6. Identification of sedimentary rocks in hand specimen.
7. Identification of sedimentary rocks in microscopic level.
8. Resistivity Survey

EQUIPMENT REQUIRED

1. Petrological Microscope
2. Pipette, Burette, Conical Flask
3. Hot oven
4. Measuring Tape
5. Brunton Compass
6. Resistivity measuring set.
7. Gravity Meter, Simple Pendulum.
8. Magnetometer.
9. Radioactivity meter – Geiger muller counter, Scintillation Counter
10. Torson Gravimeter.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Determine the true and apparent dip.

CO2: Able to handle petrological microscope and identify the samples.

CO3: Use resistivity tools and determine the water saturation.

CO4: Create grain size distribution.

CO5: Understand subsurface structures using contours.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	Determine the true and apparent dip.	3	3	2	3	-	-	-	-	3	3	-	-	3	2	-	-
CO2	Able to handle petrological microscope and identify the samples	3	3	3	2	2	-	-	-	2	2	-	-	3	2	-	-
CO3	Use resistivity tools and determine the water saturation.	3	2	2	2	3	-	-	–	3	3	-	-	3	2	-	-
CO4	Create grain size distribution.	3	2	2	3	-	-	-	-	3	2	-	-	3	2	-	-
CO5	Understand subsurface structures using contours. .	2	3	2	3	-	-	-	-	3	2	-	-	3	3	-	-
Overall CO		3	3	2	3	3	-	-	-	3	2	-	-	3	2	-	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

Attested

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AS5501 **WELL COMPLETION TECHNIQUES**

L T P C
3 0 0 3

OBJECTIVES

The course is aimed to

- To analyze well design and managing conditions.
- To study about the designing of drill string and material properties.
- To learn about the completion types and performance of the equipment's.
- To study about the tubing design and selection of string equipment's.
- To learn about perforation and sand control techniques.

UNIT I **9**

Well design: Prediction of formation pore pressure and stress gradients-Determination of safety mud weight bounds for different in-situ stress conditions-Design and planning well trajectory-Surveying tools and methods**.**

UNIT II **9**

Design of drill string including bottom hole assembly-(BHA) Drilling methods and equipment for directional, horizontal and multilateral wells-Selection of casing shoes, material properties and design of casing program**.**

UNIT III **9**

Well Completion and Stimulations: Well completion design, types of completion, completion selection and design criteria-Interval selection and productivity considerations: effects of producing mechanisms-Inflow performance and multiple tubing performance analyses using commercial software.

UNIT IV **9**

Well stimulation and workover planning-Tubing-packer movement and forces-Tubing design: graphical tubing design and simplified tensional strength design-Selection of down-hole equipment, tubing accessories and wellhead equipment.

UNIT V **9**

Basics of perforation, selection of equipment and procedure for perforation oil and gas wells-Technology of sand control: gravel packing-Fundamentals of well stimulation technologies: acidization and hydraulic fracturing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the concept of well completion basics and managing conditions.

CO2: Obtain the knowledge about the drill string designing.

CO3: Gain the knowledge about completion types and design criteria

CO4: Understand the concept of pressure maintenance and material properties.

CO5: Obtain the knowledge about the perforation techniques.

Attested

TEXT BOOKS:

1. "Advanced Well Completion Engineering", 3rd edn by Renpu Wan, Gulf Professional Publishing, 2011
2. Rabia. H., "Well Engineering and Construction", Entrac Petroleum, 2001

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REFERENCE :

1. "Standard Hand Book of Petroleum & Natural Gas Engineering" – 3rd Edition 2015-William C.Lyons&GaryJ.Plisga-Gulf professional publishing comp (Elsevier).

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the concept of well completion basics and managing conditions.	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	2
CO2	Obtain the knowledge about the drill string designing	2	3	3	2	-	-	-	-	-	-	-	-	2	-	-	-
CO3	Gain the knowledge about completion types and design criteria	3	-	2	-	3	-	-	–	-	-	-	-	3	-	-	-
CO4	Understand the concept of pressure maintenance and material properties.	-	-	3	3	-	-	-	-	-	-	-	-	3	-	-	-
CO5	Obtain the knowledge about the perforation techniques	3	-	-	-	2	-	2	-	-	-	-	-	3	-	-	2
Overall CO		3	3	3	3	3	-	2	-	-	-	-	-	3	-	-	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

Attested

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AS5502 **NATURAL GAS ENGINEERING** **L T P C**

3 0 0 3

OBJECTIVE:

The course is aimed to

- To know about the properties of natural gas.
- To understand salient features of a gas reservoir.
- To develop production systems for natural gas.
- To study about the natural gas treating techniques.
- To learn about the natural gas recovery techniques.

UNIT I PROPERTIES AND COMPOSITION OF NATURAL GAS 9

Natural gas origin – Composition of natural gas – Sources of Natural gas–Thermodynamics properties – Compressibility factor and chart for natural gas – Heating value and flammability limit of natural gas.

UNIT II ESTIMATION AND PRODUCTION OF NATURAL GAS 9

Estimation of gas reserves by volumetric method – Production of natural gas –Pressure decline method – Problems in the production of natural gas – Field separation.

UNIT III GAS FROM CONDENSATE OIL FIELDS 9

Processing of condensate well fluids – Cycling of gas condensate reservoirs – Sweep patterns – Katy cycling plant.

UNIT IV ACID GAS TREATING OF NATURAL GAS 9

Acid gas removal: Metal oxide process – Slurry process – Amine process –Carbonate washing process – Methanol based process and other process – Sulphur recovery process.

UNIT V DEHYDRATION OF NATURAL GAS AND NGL RECOVERY 9

Dehydration: Glycol dehydration – Solid desiccant dehydration. NGL Recovery: Refrigeration process – Lean oil absorption process – Solid bed adsorption and membrane separation process – NGL fractionation.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1. Understand the properties of natural gas.

CO2. Apply different measures in the recognition of reservoir performance.

CO3. Understand and apply flow behaviour of gas in production tubing

CO4. Conversant with different methods of processing of gas

CO5. Understand and apply gas compression fundamentals

CO6. Conversant with the system of gathering stations, modes of transportation and problems associated.

TEXT BOOKS:

1. Katz and Lee “Hand Book of Natural Gas Engineering” McGraw Hill, 1968.
2. Lyons, W.C., “Standard Handbook of Petroleum and Natural Gas Engineering”, Vol.2, Gulf Professional Publishing, Elsevier Inc., 2006.

REFERENCES:

1. Katz, D. L. and Lee, R.L., “Natural Gas Engineering”, McGraw Hill, 1990.

2. Dring, M.M., “The Natural Gas Industry – A Review of World Resources and Industrial Applications”, Butterworth, 1974.
3. Saied Mokhatab, William A. Poe, and James G. Speight, “Handbook of Natural Gas
4. Transmission and Processing”, Gulf Professional Publishing, Elsevier Inc., 2006.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the properties of natural gas.	3	3	2	2	-	-	-	-	-	-	-	-	3	-	3	-
CO2	Apply different measures in the recognition of reservoir performance.	3	-	-	-	2	-	-	-	-	-	1	-	3	2	-	3
CO3	Understand and apply flow behaviour of gas in production tubing	2	-	-	3	3	-	1	–	-	-	-	-	3	-	3	-
CO4	Conversant with different methods of processing of gas.	-	-	-	2	3	-	-	-	-	-	-	-	2	-	3	-
CO5	Understand and apply gas compression fundamentals	-	3	2	-	3	-	-	-	-	-	1	-	3	-	2	2
Overall CO		3	3	2	2	3	-	1	-	-	-	1	-	3	2	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5503 PETROLEUM PRODUCTION ENGINEERING L T P C

3 0 0 3

OBJECTIVES

The course is aimed to

- To analyse the well equipment's and testing
- To learn about the various well structures and their production**s.**
- To study separation and treatment of produced oil and associated surface facilities.
- To study offshore production technology.
- To understand well investigation techniques and remediation of well production problems

UNIT I **9**

Well Head Equipment: Christmas tree, valves, hangers, flow control devices, packers, tubular and flow lines-Well completion Methods-Perforating Oil & Gas Wells- Conventional and Unconventional techniques viz. through tubing and tubing conveyed underbalanced perforating techniques, type size and orientation of perforation holes- Well activation, use of compressed air & liquid Nitrogen-Down-hole equipment: selection, servicing, installation & testing, smart wells- Intelligent completions.

UNIT II **9**

Production System Analysis & Optimization- Self flow wells: PI & IPR of self flowing and artificial lift wells-Production testing - back pressure test, flow after flow test & isochronal test-Surface layout, test design & analysis of test data-Production characteristics of Horizontal and multilateral wells-coning, IPR & skin factor. Multiphase flow in tubing and flow-lines- Sizing, selection and performance of Tubing, chokes and surface pipes-Production Optimization – Nodal System analysis.

UNIT III **9**

Well Production Problems and mitigation: Scale formation, paraffin deposition, formation damage, water production, gas production, sand deposition etc. - Designing Gravel Pack for Sand Control-Sand control techniques- Formation Sand Size analysis-Optimum gravel - sand ratio-Gravel pack thickness-Gravel selection-Gravel packing fluid-Gravel pack techniques.

UNIT IV **9**

Well Stimulation Techniques - Type & description of stimulation techniques-Design of matrix acidization and acid fracturing-Design of hydraulic fracturing, Multistage Fracturing-Wave technology & microbial stimulation

UNIT V **9**

Artificial Lift Techniques: Sucker Rod Pump-Gas Lift Techniques-Hydraulic Piston Pump-Hydraulic Jet Pump-Plunger Lift-Progressive Cavity Pump- Electrically Submersible Pump.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Demonstrate working principle and design of separators

CO2: Illustrate various equipment and processes for the treatment on produced emulsion

CO3: Understand mechanism and factors of oil field corrosion and methods for prevention.

CO4: Understand and apply production logging operations.

CO5: Do problem well analysis and apply new techniques to sustain production rates and comprehend emerging and peripheral technologies for lifelong learning.

REFERENCES:

1. Petroleum Production Engineering by Boyun Guo, William C. Lyons (2007).
2. The Technology of Artificial Methods by Kermit E.Brown (1982).

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Demonstrate working principle and design of separators.	3	-	3	-	2	-	-	-	-	-	-	-	3	-	3	2
CO2	Illustrate various equipment and processes for the treatment on produced emulsion	-	-	3	2	3	-	2	-	-	-	-	-	3	-	3	3
CO3	Understand mechanism and factors of oil field corrosion and methods for prevention.	3	-	2	-	-	-	-	–	-	-	-	-	3	-	-	3
CO4	Understand and apply production logging operations	3	2	-	-	2	-	-	-	-	-	-	-	3	3	3	3
CO5	Do problem well analysis and apply new techniques to sustain production rates and comprehend emerging and peripheral technologies for lifelong learning.	-	3	2	3	3	-	-	-	-	-	-	3	3	3	-	3
Overall CO		3	3	3	3	3	-	2	-	-	-	-	3	3	3	-	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5504 **MASS TRANSFER** **L T P C**
31 0 4

OBJECTIVE:

The course is aimed to

- To provide a basic introduction to the molecular diffusive and convective mass transfer.
- To learn deeply about Gas absorption and stripping.
- To study the detailed view of Distillation.
- To learn the different types of extractor and its applications
- To learn about various membrane separation process involved in the industry

UNIT I DIFFUSION AND MASS TRANSFER COEFFICIECT 9

Introduction to mass transfer operations; Molecular diffusion in gases, liquids and solids; diffusivity measurement and prediction; multi-component diffusion. Eddy diffusion, concept of mass transfer coefficients, theories of mass transfer, different transport analogies, application of correlations for mass transfer coefficients, interphase mass transfer, relationship between individual and overall mass transfer coefficients.

UNIT II ABSORPTION 9

Gas Absorption and Stripping – Equilibrium; material balance; limiting gas-liquid ratio; tray tower absorber - calculation of number of theoretical stages, tray efficiency, tower diameter; packed tower absorber – rate based approach; determination of height of packing using HTU and NTU calculations.

UNIT III DISTILLATION 9

Vapour liquid equilibria - Raoult's law, vapor-liquid equilibrium diagrams for ideal and non-ideal systems, enthalpy concentration diagrams. Principle of distillation - flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by McCabe - Thiele method and Ponchan - Savarit method, Total reflux, minimum reflux ratio, optimum reflux ratio. Introduction to multi-component distillation, azeotropic and extractive distillation

UNIT IV LIQUID-LIQUID EXTRACTION 9

Liquid - liquid extraction - solvent characteristics-equilibrium stage wise contact calculations for batch and continuous extractors- differential contact equipment-spray, packed and mechanically agitated contactors and their design calculations-packed bed extraction with reflux. Pulsed extractors, centrifugal extractors-Supercritical extraction

UNIT VADSORPTION AND ION EXCHANGE & MEMBRANE SEPARATION PROCESS 9

Adsorption - Types of adsorption, nature of adsorbents, adsorption equilibria, effect of pressure and temperature on adsorption isotherms, Adsorption operations - stage wise operations, steady state moving bed and unsteady state fixed bed adsorbers, break through curves. Principle of Ion exchange, techniques and applications. Solid and liquid membranes; concept of osmosis; reverse osmosis; electro dialysis; ultra-filtration.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the fundamentals, types and mechanism of mass transfer operations

CO2: Understand the theories of mass transfer and the concept of inter-phase mass transfer

CO3: Understand the basics of distillation process and its application

CO4: Describe core principles of extraction, setting up mass balances, use graphical methods to estimate the number of ideal stages in leaching operation.

CO5: Understand the concept of adsorption techniques, various isotherms, membrane separation

techniques and ion exchange process.

TEXT BOOKS:

1. Wankat, P., “Equilibrium Stage Separations”, Prentice Hall, 1993.
2. Treybal, R.E., “Mass Transfer Operations “, 3rd Edn., McGraw-Hill, 2017.
3. Geankoplis, C.J., “Transport Processes and Unit Operations”, 4th Edition, Prentice Hall Inc., New Jersey, 2003.

REFERENCES:

1. Seader, J.D. and E.J. Henley, “Separation Process Principles”, 2nd Ed., John Wiley, 2006.
2. McCabe, W.L., Smith, J.C., and Harriot, P., “Unit Operations in Chemical Engineering”, 7th Edition., McGraw-Hill, 2005.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the fundamentals, types and mechanism of mass transfer operations	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	Understand the theories of mass transfer and the concept of inter-phase mass transfer	2	3	-	2	-	-	-	-	-	-	-	-	2	-	-	2
CO3	Understand the basics of distillation process and its application	3	-	-	-	3	-	-	–	-	-	-	-	3	-	-	3
CO4	Describe core principles of extraction, setting up mass balances, use graphical methods to estimate the number of ideal stages in leaching operation.	3	2	3	2	-	-	-	-	-	-	-	-	3	-	-	2
CO5	. Understand the concept of adsorption techniques, various isotherms, membrane separation techniques and ion exchange process	3	2	2	3	-	-	-	-	-	-	-	-	3	-	-	2

Overall CO	3	2	3	2	3	-	-	-	-	-	-	-	3	-	-	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

AS5511 MASS TRANSFER LABORATORY L T P C

0 0 4 2

OBJECTIVES

The course is aimed to

- To learn the basic principles involved in mass transfer equipment
- To apply the concepts of mass transfer to the extraction and absorption processes
- To study the drying characteristics of various types of dryers
- To use different distillation methods to separate a binary mixture
- To study the performance of mass transfer equipment

LIST OF EXPERIMENTS

1. Separation of binary mixture using simple distillation
2. Separation of binary mixture using Steam distillation
3. Separation of binary mixture using Packed column distillation
4. Measurement of diffusivity
5. Liquid-liquid extraction
6. Drying characteristics of Vacuum Dryer
7. Drying characteristics of Tray dryer
8. Drying characteristics of Rotary dryer
9. Estimation of mass/heat transfer coefficient for cooling tower.
10. Demonstration Gas – liquid Absorption

EQUIPMENTS REQUIRED

1. Simple distillation setup
2. Steam distillation setup
3. Packed column Liquid-liquid extractor
4. Liquid – Liquid Extractor
5. Vacuum Dryer
6. Tray dryer
7. Rotary dryer
8. Rotating Disc Contactor
9. Cooling Tower
10. Absorption Column

Minimum 10 experiments shall be offered.

TOTAL : 60 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Determine the diffusivity practically and compare the results with the empirical correlations.

CO2: Estimate the mass transfer rate and mass transfer co-efficient

CO3: Evaluate the performance/calculate the parameters in different distillation processes

CO4: Evaluate the performance/calculate the parameters in leaching and extraction operations

CO5: Estimate the drying characteristics

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Determine the diffusivity practically and compare the results with the empirical correlations.	2	-	3	3	3	-	-	-	2	3	-	-	3	-	2	-
CO2	Estimate the mass transfer rate and mass transfer co-efficient	-	3	2	2	2	-	-	-	3	2	-	-	2	-	3	-
CO3	Evaluate the performance/calculate the parameters in different distillation processes	-	-	3	-	-	2	-	–	2	3	-	-	2	-	2	-
CO4	Evaluate the performance/calculate the parameters in leaching and extraction operations	2	-	-	3	-	-	-	-	2	3	-	-	2	-	3	-
CO5	Estimate the drying characteristics	-	3	-	-	3	-	-	-	3	2	-	-	2	-	2	-
Overall CO		2	3	3	3	3	2	-	-	2	3	-	-	2	-	2	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5512 PETROLEUM TESTING LABORATORY L T P C

00 4 2

OBJECTIVES:

The course is aimed to

- To be conversant with the theoretical principles and experimental procedures for quantitative estimation.
- To measure viscosity of oil samples using various types of viscometers
- To test the samples for the study of engine performance
- To study the properties of oil samples
- To do the qualitative testing of fuels

LIST OF EXPERIMENT

1. Determination of flash point.
2. Carbon residue determination of petroleum products.
3. Distillation of crude oil
4. Determination of viscosity capillary viscometer.
5. Density of crude oil by hydrometer.
6. Pour point of crude oil and petroleum products.
7. Determination of calorific value of fuels.
8. Determination of refractive index of the petroleum products.
9. Determination of salacity of oil field waters
10. Characterization of formation waters
11. Water content in crude oil
12. Moisture content in crude oil and products
13. BS&W in crude oil

LIST OF EQUIPMENT

1. Flash point apparatus.
2. Centrifuge
3. Dean and Stark Apparatus
4. API standard distillation apparatus
5. Capillary Viscometer
6. Gas Chromatograph
7. Bomb calorimeter
8. Refractometer
9. Junker gas calorimeter
10. Glass wares, balance, hot plate and heating mantle
11. Pour Point Apparatus
12. Karl Fisher Apparatus

TOTAL : 60 PERIODS

COURSE OUTCOME:

On completion of the course students are expected to

CO1:Understand the basic principles involved in testing of Petroleum products bydifferent techniques.

CO2: Be expertise in the testing equipment.

CO3:Be well versed in properties of oil and gas products.

CO4:Acquire the data from the testing equipment and interpret it.

CO5:Understand the industrial application of concept.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the basic principles involved in testing of Petroleum products by different techniques	3	2	2	3	2	-	-	2	3	2	-	-	3	-	-	-
CO2	Be expertise in the testing equipment.	-	-	-	3	3	-	-	-	2	3	-	-	3	-	2	-
CO3	Be well versed in properties of oil and gas products.	-	2	-	3	2	-	-	–	3	2	-	-	2	2	3	-
CO4	Acquire the data from the testing equipment and interpret it.	-	3	2	2	2	-	-	-	3	3	-	-	2	3	2	-
CO5	. Understand the industrial application of concept.	-	-	2	2	2	3	-	-	2	3	-	-	3	2	-	-
Overall CO		3	2	2	3	2	3	-	2	3	3	-	-	3	2	2	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5601 PETROLUEM FORMATION AND EVALUATIONL T P C

3 0 0 3

OBJECTIVE:

The course is aimed to

- To apply quick look methods of log interpretation.
- To analyse open hole logs and integrate log and core data to obtain properties of rocks and fluids.
- To learn about the types of tools and its applications
- To gain the knowledge on DSI and NMR logging principles.
- To analyse the log interpretation and techniques.

UNIT I **9**

Petrophysical measurements to sub-surface engineering.

UNIT II **9**

Indirect Methods: SP and resistivity logs, radioactive logs, acoustic logs (principles, types of tools, limitation and applications). Evaluation of CBL/ VDL, USIT, SFT, RFT.

UNIT III **9**

Production Logging: Introduction, type of tools, principles, limitations and applications.

UNIT IV **9**

Special Type of Logging Tools: Casing inspection tools (principles, application and limitation), Formation micro scanner (FMS), DSI, NMR logging principles. Logging in high- angle wells.

UNIT V **9**

Log Interpretation and Analysis Techniques. Standard log interpretation methods, Cross-plotting methods: neutron-density, sonic-density and sonic-neutron etc.clean sand interpretation Concepts of invasion – RXO, Tornado charts, Shaly sand interpretation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1. Apply different logging methods for the evaluation of subsurface formations

CO2. Apply principles of mud logging in the recognition of oil and gas show

CO3. Apply principles of physics in the recognition and calculation of different parameters of formations

CO4. Apply quick look interpretation methods in the evaluation of hydrocarbon recognition

CO5. Interpret broad depositional environment from log signatures.

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TEXT BOOKS:

1. Standard Handbook of petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing (2004).
2. D.P Helander 'Fundamentals of Formation Evaluation' (1983).
3. Dewan.J.T 'Essentials of Modern Open-Hole Log Interpretation' Pen Well Books, 1983, ISBN 0878142339.

REFERENCE:

1. Serra.O 'Fundamentals of Well log Interpretation' Volume1. Elsevier Science Publisher, New York, 1988, ISBN 04441327.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Apply different logging methods for the evaluation of subsurface formations	3	-	3	2	2	2	-	-	-	-	-	2	3	3	2	-
CO2	Apply principles of mud logging in the recognition of oil and gas show .	3	2	3	1	2	2	-	-	-	-	-	-	3	2	2	-
CO3	Apply principles of physics in the recognition and calculation of different parameters of formations	3	-	3	2	-	-	-	-	-	-	-	-	2	3	2	-
CO4	Apply quick look interpretation methods in the evaluation of hydrocarbon recognition.	3	2	2	-	3	-	-	-	-	-	-	-	3	3	2	-
CO5	. Interpret broad depositional environment from log signatures.	3	-	3	-	3	-	-	-	-	-	-	-	2	3	2	-

Overall CO	3	2	3	2	3	2	-	-	-	-	-	2	3	3	2	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

AS5602 FLOW ASSURANCE IN PETROLEUM INDUSTRIES L T P C
3 0 0 3

OBJECTIVES

The course is aimed to

- To learn the fundamentals in flow assurance.
- To gain knowledge on the hydraulics.
- To know about transfer of heat in flow assurance.
- To characterize the formation mechanism for organic deposits.
- To learn about the removal and prevention methods of organic deposits.

UNIT I INTRODUCTION TO FLOW ASSURANCE 9

Flow Assurance concerns and challenges; Economic impact of Flow Assurance problems,components of typical Flow Assurance process; Composition and Properties of Hydrocarbons; Equations of State; Phase behaviour of hydrocarbons, Compositional and Physical Characterization of Crude oil.

UNIT II HYDRAULICS IN FLOW ASSURANCE 9

Hydrocarbon flow, single phase and multiphase flow, Two phase flow correlations; Slugging and Liquid Handling, Types of slugs, Slug prediction, detection and control systems; Pressure surge analysis; Hydraulic/Pressure drop calculations.

UNIT III HEAT TRANSFER IN FLOW ASSURANCE 9

Buried pipeline heat transfer, Temperature prediction along the pipeline in steady state and transient modes; Thermal management strategy like external coating systems, direct heating, pipe in pipe, etc.; Insulation performance

UNIT IV CHARACTERIZATION AND FORMATION MECHANISMS FOR ORGANIC DEPOSITS 9

Characterization, Formation mechanism, prediction and models for deposition and stabilityfor wax (Paraffins), Asphaltenes and Gas Hydrates

UNIT V ORGANIC DEPOSITS REMOVAL AND PREVENTION METHODS 9

Mechanical Removal Methods like Coiled Tubing, Pigging, Pressurization Depressurizationetc.; Chemical Solvents and Dispersants, Other techniques like Ultrasonic, Laser Technology, etc., Bacterial Removal Methods.Heating in Wellbore and Piping; Cold flow methods; Chemical inhibitors for waxes,asphaltenes and hydrates; Dehydration of Natural Gas; Special Materials and Coatings.

COURSE OUTCOMES

On completion of the course students are expected to

CO1:Predict the phase behaviour of hydrocarbons under different operating conditions.

CO2: Perform slug handling and pressure surge analysis

CO3: Implement a thermal management strategy in pipelines transporting hydrocarbons

CO4: Predict the formation of paraffin waxes, asphaltenes and hydrates in crude oil

CO5: Apply the appropriate method for prevention and removal of organic deposits.

REFERENCE

1. Bai, Y and Bai, Q. (2005). *Subsea Pipelines and Risers*. I Edition. Elsevier
2. Danesh, Ali. (1998). PVT and Phase Behaviour of Petroleum Reservoir Fluids. I Edition, Elsevier
3. Frenier, W. W., Zainuddin, M., and Venkatesan, R. (2010). *Organic Deposits in Oil and* Gas Production. Society of Petroleum Engineers.
4. Katz, Donald. (1959). Handbook of Natural Gas Engineering. I Edition. McGraw Hill Higher Education.
5. Yen, T.F and Chilingarian, G.V. (2000). *Asphaltenes and Asphalts, 2* from *Developments* in Petroleum Science. Volume 40 B, Elsevier
6. Dendy Sloan, Carolyn Ann Koh, Amadeu K. Sum, Norman D. McMullen, George Shoup, Adam L. Ballard, and Thierry Palermo (Editors), 2011, Natural Gas Hydrates in Flow Assurance, Gulf Professional Publishing, 213 pp.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome														
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	Predict the phase behaviour of hydrocarbons under different operating conditions.	3	2	-	-	2	3	-	-	-	-	-	-	3	-	2	-
CO2	Perform slug handling and pressure surge analysis.	-	2	-	-	2	2	-	-	-	-	-	-	3	2	-	-
CO3	Implement a thermal management strategy in pipelines transporting hydrocarbons	2	-	-	-	3	2	-	-	-	-	-	-	3	-	2	-
CO4	Predict the formation of paraffin waxes, asphaltenes and hydrates in crude oil	-	3	-	-	2	2	-	-	-	-	-	-	3	-	3	-
CO5	. Apply the appropriate method for prevention and removal of organic deposits.	3	-	-	-	3	2	-	-	-	-	-	-	3	-	2	-

Overall CO	3	2	-	-	2	2	-	-	-	-	-	-	3	2	2	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

HS5461 EMPLOYABILITY SKILLS **L T P C**

0 04 2

OBJECTIVES

- Toenhancetheemployabilityskillsofstudentswithaspecialfocusonpresentation skills, group discussion skillsandinterviewskills
- Tohelpthemimprovetheirreadingskills,writingskills,andsoftskillsnecessaryforthe workplacesituations
- Tomakethem employable graduates

UNITI WRITINGSKILLS **12**

Preparingjob applications-writingcoveringletterandrésumé-applyingfor jobsonline-email etiquette – writingofficial letters(placinganorder, letterstoconsumers,etc.)

UNITII SOFTSKILLS **12**

Hardskills&softskills– softskills:self-managementskills&peopleskills-traininginsoftskills-persuasiveskills–sociability skills–interpersonalskills–teambuildingskills–leadershipskills–problemsolvingskills–adaptability– motivation techniques –lifeskills.

UNITIII PRESENTATION SKILLS **12**

Preparingslideswith animationrelatedtothetopic–organizing thematerial-Introducingoneself totheaudience– introducingthetopic –answeringquestions– individualpresentationpractice—presenting the visualseffectively–5minute presentation.

UNITIV GROUP DISCUSSION SKILLS **12**

Participatingin groupdiscussions–understanding groupdynamics-brainstormingthetopic—questioningand clarifying–GDstrategies(expressingopinions,acceptingor refusingothers opinions,turntaking)–activities to improve GD skills–viewingrecordedGD-mock GD.

UNITV INTERVIEWSKILLS **12**

Interviewetiquette–dresscode–bodylanguage– mockinterview-–attendingjobinterviews–answering questions confidently– technicalinterview – telephone/Skypeinterview -one to one interview&panel interview –FAQsrelatedtojobinterview-Emotional andcultural intelligence.

TOTAL:60PERIODS

Teaching Methods

Seminar, Presentation, GroupDiscussion, Employabilityskillspracticein thelanguagelaboratory

Evaluation

ContinuousAssessment– 100marks

a) GroupDiscussionSkills -25marks b) Presentationskills -25marks c)

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Interviewskills -25marks d)
Assignment (JobApplication and official letters) -25marks
Total -100marks
EndSemesterexamination–NIL

OUTCOMES

Afterthecompletionof thecourse,thelearners will beable to,

- Perform well atplacementinterviews, groupdiscussionsand other recruitment exercises
- Acquireadequatecompetenceinspeaking,readingandwritingskillsneededfor workplace relatedsituations
- Gain acomprehensive knowledge aboutsoft skills

REFERENCES:

1. Corneilssen,Joep.HowtoPrepareforGroupDiscussionandInterview.NewDelhi: Tata- McGraw-Hill,2009.
2. Dabreo,DesmondA.GroupDiscussionandTeamBuilding.Mumbai:BetterYourselfBooks, 2004.
3. Ramesh,Gopalswamy, andMahadevanRamesh.TheACEofSoft Skills. NewDelhi: Pearson, 2010.
4. Gulati, Sarvesh.Corporate Soft Skills.NewDelhi:Rupa and Co.2006.
5. VanEmden,Joan,andLucindaBecker.PresentationSkillsforStudents.NewYork:Palgrave Macmillan,2004.

WEB RESOURCES

1. www.humanresources.about.com
2. www.careerride.com
3. https://bemycareercoach.com/softskills

AS5611 DRILLING FLUIDS AND CEMENTING LABORATORY **L T P C**

0 0 2 1

OBJECTIVES

The course is aimed to

- To study the various properties of drilling fluid
- To learn the preparation of cement slurries
- To learn the underlying principles of the equipments used
- To prepare a drilling fluid based on the given specifications
- To learn about the additives which are used to alter the properties

LIST OF EXPERIMENTS

Determination of Properties

I. Mud weight
II. Plastic viscosity
III. Gel strength
IV. Filtration loss
V. Sand content
VI. Salt contents etc.

1. Practical related to the setting point and the consistency of cement slurry

TOTAL: 30 PERIODS

LIST OF EQUIPMENT

1. Mud weight – Mud Balance
2. Viscosity
3. Filtration Loss
4. pH Meter – Generic (Can be used in all Labs)
5. Sand Content
6. Cement Consistency – Consistometer
7. Cement Mechanical Properties
8. Porosity- Porosimeter
9. Permeability- Permeameter
10. BHP Chart analysis

Attested

COURSE OUTCOME:

On completion of the course students are expected to

CO1: Understand the design of mud balance and how to be able todetermine the density of drilling fluids.

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CO2:Able to handle the Fann Viscometer and to determine PV and gel strength.
CO3: Handle API filtration loss equipment and determine themud cake thickness.
CO4:Determine the sand content in the drilling fluids.

CO5: Determine the salt content in the drilling fluids.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the design of mud balance and how to be able to determine the density of drilling fluids.	-	2	3	2	3	-	-	-	3	2	-	-	3	2	2	-
CO2	Able to handle the Fann Viscometer and to determine PV and gel strength.	3	2	2	3	2	-	-	-	2	3	-	-	3	-	2	-
CO3	Handle API filtration loss equipment and determine the mud cake thickness.	2	3	3	2	2	-	-	-	3	2	-	-	3	2	-	-
CO4	Determine the sand content in the drilling fluids.	-	3	2	3	2	-	-	-	2	3	-	-	3	-	-	-

CO5	Determine the salt content in the drilling fluids.	-	2	2	3	-	-	-	-	3	2	-	-	3	-	-	-
Overall CO		3	2	2	3	2	-	-	-	3	2	-	-	3	2	2	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

AS5701 PETROLEUM EQUIPMENT DESIGNL T P C

3 0 0 3

OBJECTIVE

The course is aimed to

- To learn about heat transfer operations.
- To study about the separation equipment.
- To study about mass transfer process equipment's.
- To learn about design of storage and reactor vessel.
- To analyse about plant layout and construction.

UNIT I HEAT TRANSFER OPERATIONS 9

Fired heaters, Heat Exchangers, Condensers, Evaporators, Reboilers,

UNIT II DESIGN OF PHASE SEPARATION EQUIPMENT 9

Design of physical separation equipment such as cyclones, centrifuges, thickeners,filtration equipment

UNIT III MASS TRANSFER OPERATIONS 9

Absorption column, Distillation Column, Extraction Column, Cooling tower, Dryer, Crystallizer

UNIT IV REACTORS AND STORAGE VESSELS 9

Packed bed Reactors, FCC units, Pressure Vessel, Storage Vessel

UNIT V MATERIALS OF CONSTRUCTION AND PLANT LAYOUT 9

Design of Plant Layout, Pipe Lines and Pipe Layouts, Design Schematics and Presentation, Materials of Construction and Selection of process

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the piping fundamentals, codes and standards

CO2: Understand pipe fittings, selections, drawings and dimensioning

CO3: Understand Pipe Material specifications

CO4: Understand pressure design of pipe systems

CO5: Understand the materials of constrictions and plant layout.

REFERENCES

1. Baranan, C.R., "Rules of Thumb for Chemical Engineers", 3rd Edition, Gulf Professional Publishing Co, Texas, 2002.
2. R. K. Sinnott, "Coulson & Richardson's Chemical Engineering Design ", Vol. 6, IV Edition Butterworth Heinermann, Oxford, 2005.
3. Dawande, S. D., "Process Design of Equiments", IV Edition, Central Techno Publications, Nagpure, 2005.
4. Green D. W., "Perry's Chemical Engineer's Handbook", VIII Edition McGraw Hill, 2007.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the piping fundamentals, codes and standards	3	2	-	2	-	-	2	2	-	-	3	-	3	-	-	2
CO2	Understand pipe fittings, selections, drawings and dimensioning.	3	2	3	3	2	-	3	-	-	-	-	-	3	-	2	2
CO3	Understand Pipe Material specifications.	3	2	3	-	2	-	2	-	-	2	-	-	3	1	-	3
CO4	Understand pressure design of pipe systems.	3	2	3	2	-	-	3	-	-	-	1	-	3	-	-	2
CO5	Understand the materials of constrictions and plant layout.	3	3	3	-	3	-	2	-	-	-	-	-	3	-	-	3
Overall CO		3	2	3	2	2	-	2	2	-	2	3	-	3	1	2	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5702 PROCESS INSTRUMENTATION DYNAMICS AND CONTROL L T P C

3 0 0 3

OBJECTIVES

The course is aimed to

- To analyze the different types of parameter
- To introduce dynamic response of open and close system.
- To analyze the instruments handling while processing.
- To study about the frequency-based loop system.
- To analyze the modern and advanced control systems.

UNIT I INSTRUMENTATION 9

Principles of measurements and classification of process instruments, measurement of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity, pH, concentration, electrical and thermal conductivity, humidity of gases.

UNIT II OPEN LOOP SYSTEMS 9

Laplace transformation, application to solve ODEs. Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag.

UNIT III CLOSED LOOP SYSTEMS 9

Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatory problems, transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transient response of closed-loop control systems and their stability.

UNIT IV FREQUENCY RESPONSE 9

Introduction to frequency response of closed-loop systems, control system design by frequency response techniques, Bode diagram, stability criterion, tuning of controller settings

UNIT V ADVANCED CONTROL SYSTEMS 9

Introduction to advanced control systems, cascade control, feed forward control, Smith predictor controller, control of distillation towers and heat exchangers, introduction to computer control of chemical processes.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand process industry as it allows real-time measurement and control of process variables such as levels, flow, pressure, temperature, pH, and humidity.

CO2: Develop transient models for chemical processes using material and/or energy balance equations by incorporating constitutive relationships and seek their solution using Laplace Transforms.

CO3: Develop transient models for chemical processes using material and/or energy balance equations by incorporating constitutive relationships and seek their solution using Laplace Transforms.

CO4: Understand Frequency response of control systems and tune the PID controllers

CO5: Appreciate the performance augmentation of PID controllers by using advanced control strategies such as Cascade, Feed forward, Dead time compensation.

TEXT BOOKS

1. Stephanopoulos, G., "Chemical Process Control", Prentice Hall of India, 2003.
2. Coughnowr, D., " Process Systems Analysis and Control ", 3rd Edn., McGraw Hill, New York, 2008.

REFERENCES

1. Marlin, T. E., "Process Control ", 2nd Edn, McGraw Hill, New York, 2000.
2. Smith, C. A. and Corripio, A. B., "Principles and Practice of Automatic Process Control", 2nd Edn., John Wiley, New York, (2005).

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand process industry as it allows real-time measurement and control of process variables such as levels, flow, pressure, temperature, pH, and humidity.	3	2	2	2	3	2	-	-	-	-	-	-	2	-	-	1
CO2	Develop transient models for chemical processes using material and/or energy balance equations by incorporating constitutive relationships and seek their solution using Laplace Transforms.	2	3	2	3	3	-	-	-	-	-	-	-	3	-	-	1
CO3	Develop transient models for chemical processes using material and/or energy balance equations by incorporating constitutive relationships and seek their solution using Laplace Transforms.	2	2	-	-	2	-	-	-	-	-	-	-	2	-	-	2

CO4	Understand Frequency response of control systems and tune the PID controllers.	3	3	-	-	2	-	-	-	-	-	-	-	2	-	-	3
CO5	Appreciate the performance augmentation of PID controllers by using advanced control strategies such as Cascade, Feed forward, Dead time compensation.	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-	2
Overall CO		3	2	2	3	2	2	-	-	-	-	-	-	2	-	-	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

AS5703 WATER FLOODING AND ENHANCED OIL RECOVERY L T P C
3 0 0 3

OBJECTIVES:

The course is aimed to

- To learn the types of recovery mechanisms
- To know about the factors involved in EOR
- To understand the concept of water flooding
- To learn the mechanism involved in various flooding techniques
- To predict the future performance of a reservoir

UNIT I **9**

Definition of EOR - Target Oil Resource for EOR - Idealized Characteristics of an EOR Process - General Classifications and Description of EOR Process - Potential of the Different Processes - Screening Criteria for Process

UNIT II **9**

Capillary Forces - Viscous Forces - Phase Trapping - Mobilization of Trapped Phases - Alteration of Viscous/Capillary Force Ratios. Areal sweep efficiency, vertical sweep efficiency, Volumetric displacement efficiency, mobility ratio, well spacing.

UNIT III **9**

Sampling and analysis of Oil Field Water Water flooding performance calculations: Frontal advance method, viscous fingering method, Stiles method, Dykstra-Parsons Method.

UNIT IV **9**

Flooding – miscible, CO_2, polymer, alkaline, surfactants, steam.

UNIT V **9**

Gas injection, in-situ combustion technology, microbial method Precipitation and Deposition of Asphaltenes and Paraffins, Scaling Problems, Formation of Damage Due to Migration of Fines, Environmental factors.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Understand the purpose of enhanced recovery process.

CO2: Understand the concept of capillary force, viscousforce and how it traps the oil.

CO3: Understand the sampling and analysis of reservoir fluid and to develop flooding fluidwhich is

suitable for that particular field.

CO4:Understand the flooding mechanisms.

CO5: Understand how gas injection works to maintain the reservoir pressure and to understand themechanism leading to positive skin.

REFERENCE:

1. Enhanced Oil Recovery by Don W Green & G. Paul Willhite (2018).
2. Donaldson, E.C. and G. V. Chilingarian, T. F. Yen, “Enhanced oil Recovery – I &II”(1989),
3. Fundamentals and Analysis, Elsevier Science Publishers, New York, (1985).
4. Lake, L.W., “Enhanced oil recovery”, Prentice Hall, (1996).
5. Schumacher, M.M., “Enhanced oil recovery: Secondary and tertiary methods”, Noyes Data Corp., (1982).
6. Van Pollen, H.K. “Fundamentals of enhanced oil recovery”, Penn Well Books, (1980)

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome												PSO1	PSO2	PSO3	PSO4
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12				
CO1	Understand the purpose of enhanced recovery process.	3	-	-	-	2	-	2	-	-	-	-	-	3	-	2	-
CO2	Understand the concept of capillary force, viscous force and how it traps the oil.	2	3	-	3	-	-	3	-	-	-	3	-	2	-	-	2
CO3	Understand the sampling and analysis of reservoir fluid and to develop flooding fluid which is suitable for that particular field.	3	2	-	2	-	-	2	-	-	-	-	-	3	1	-	-
CO4	Understand the flooding mechanisms.	3	2	-	2	-	-	3	-	-	-	2	-	2	-	1	2
CO5	Understand how gas injection works to maintain the reservoir pressure and to understand the mechanism leading to positive skin.	2	2	-	3	-	-	2	-	-	-	-	-	3	-	-	2

Overall CO	3	2	-	3	2	-	2	-	-	-	3	-	3	1	2	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

AS5711PROCESS CONTROL AND SIMULATION LABORATORY L T P C
0 0 4 2

OBJECTIVES

The course is aimed to

- **To solve chemical engineering problems using C, Excel and MATLAB programming and also using computational tools like Aspen.**
- To understand the open loop and closed loop system
- To understand the concept of P, PI, PID controllers
- To study the characteristics of control valves

LIST OF EXPERIMENTS:

1.Programming in C

C programs will be written to solve problems from core courses of chemical and

petrochemical engineering.

2.Microsoft Excel Software

The computational, plotting and programming abilities in Excel will be used to solve different chemical engineering problems.

3.Programming in MATLAB

Chemical engineering problems will be solved using the powerful computational and graphical capability of MATLAB.

4.ASPEN Software

Individual process equipment and flowsheets will be simulated using Aspen Plus and property analysis and estimation will be done using Aspen Properties.

5. Open loop and Closed loop study on a level system

6.Open loop study and Closed loop study on a thermal system
7.Open loop and Closed loop study on a flow system
8.Response of first order system and second order system
9.Response of Non-Interacting level System and Interacting level System
10..Characteristics of different types of control valves

TOTAL: 60 PERIODS

COURSE OUTCOME:

On completion of the course students are expected to

CO1: Solve chemical engineering problems using C and MATLAB programmingand Microsoft Excel software.
CO2: Solve chemical engineering problems and design the process using ASPEN PLUS ProcessSimulator.
CO3 : Able to determine the response of a first order and second order system for various input and an interacting and non- interacting system for various input
CO4 : Understand the difference between an open loop and closed loop system and the concept of three classical controller P, PI, PID controller.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Solve chemical engineering problems using C and MATLAB programming and Microsoft Excel software.	-	3	2	-	-	-	1	-	3	2	-	-	2	-	-	1
CO2	Solve chemical engineering problems and design the process using ASPEN PLUS Process Simulator.	-	2	3	-	2	3	-	-	2	2	-	-	3	1	-	-
CO3	Able to determine the response of a first order and second order system for various input and an interacting and non-interacting system for various input	-	2	3	2	3	-	-	-	3	3	-	-	2	-	-	-
CO4	Understand the difference between an open loop and closed loop system and the concept of three classical controller P, PI, PID controller.	-	3	-	2	2	-	-	-	3	2	-	-	2	-	-	-

Overall CO	-	3	3	-	2	3	1	-	3	2	-	-	3	1	-	1

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

AS5712 **INTERNSHIP / TRAINING** **L T P C**
0 0 2 1

OBJECTIVES

- The Summer Internship / Project is aimed to make use of the knowledge gained by the student at various stages of the degree course.

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Show competence in identifying relevant information, defining and explaining topics under discussion.
CO2: Demonstrate depth of understanding, use primary and secondary technical sources.
CO3:Demonstrate complexity, independent thought, relevance, and persuasiveness
CO4: To have an ability to write technical documents
CO5: Tohave ability give oral presentations related to the review or research output.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Show competence in identifying relevant information, defining and explaining topics under discussion	3	-	-	-	2	-	2	-	-	-	-	-	3	-	2	-
CO2	Demonstrate depth of understanding, use primary and secondary technical sources.	2	3	-	3	-	-	3	-	-	-	3	-	2	-	-	2

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CO3	Demonstrate complexity, independent thought, relevance, and persuasiveness.	3	3	-	2	-	-	2	-	-	-	-	-	3	1	-	-
CO4	To have an ability to write technical documents	3	2	-	2	-	-	3	-	-	-	2	-	2	-	1	2
CO5	To have ability give oral presentations related to the review or research output.	2	2	-	3	-	-	3	-	-	-	-	-	3	-	-	2
Overall CO		3	3	-	3	2	-	3	-	-	-	3	-	3	1	2	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

AS5811 **PROJECT II** **L T P C**
0 0 16 8

OBJECTIVES

- The Project is aimed to make use of the knowledge gained by the student at various stages of the degree course.

COURSE OUTCOMES

On completion of the course students are expected to

CO1:Apply the fundamental concept learnt during the theory courses to solve industrial problems

CO2:Design a manufacturing Petrochemical process industry Prepare clear concise project reports with the help of grape, charts and pictorial representation.

CO3: Each student is required to submit a report on the project assigned to him by the department.

CO4: The report should be based on the information available in the literature or data obtained in the laboratory/industry.

CO5: Students, in addition to the home problem will be permitted to undertake industrial / consultancy project work, outside the department, in industries / Research labs for which proportional weightage will be given in the final assessment.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Apply the fundamental concept learnt during the theory courses to solve industrial problems	3	-	-	-	2	-	2	-	-	-	-	-	3	-	2	-
CO2	Design a manufacturing Petrochemical process industry Prepare clear concise project reports with the help of grape, charts and pictorial representation..	2	3	-	3	-	-	3	-	-	-	3	-	2	-	-	2
CO3	Each student is required to submit a report on the project assigned to him by the department.	3	3	-	2	-	-	2	-	-	-	-	-	3	1	-	-
CO4	The report should be based on the information available in the literature or data obtained in	3	2	-	2	-	-	3	-	-	-	2	-	2	-	1	2

	the laboratory/industry.																
CO5	Students, in addition to the home problem will be permitted to undertake industrial / consultancy project work, outside the department, in industries / Research labs for which proportional weightage will be given in the final assessment.	2	2	-	3	-	-	3	-	-	-	-	-	3	-	-	2
Overall CO		3	3	-	3	2	-	3	-	-	-	3	-	3	1	2	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

AS5015 **PETROLEUM CHEMISTRY** **L T P C**
3 0 0 3

OBJECTIVE:
The course is aimed to

- To learn about the composition and properties of Hydrocarbons.
- To learn about cracking process and mechanism.
- To learn about upgradation technologies.
- To learn about instability and incompatibility of Petroleum processes.
- To obtain knowledge on petroleum analysis and evaluation.

UNIT I **9**
Composition of petroleum, Chemical Structure of important hydrocarbons, aromatic compounds found in crude oils,preparation and physical and chemical properties and uses of Heterocyclic compounds -Pyrrole, Furan, Furfural, Tetrahydrofuran,Thiophene, Indole, Pyridine, Quinoline and Iso Quinoline.

UNIT-II **9**
Thermal Chemistry of petroleum constituents -Cracking Free radical Mechanism,Hydro cracking Chemistry, Hydrogenation catalyst -Strong acid cracking of hydrocarbons- Bronstedacid, Lewisacid, Solid strong acid catalyst,Nitrogen basis and hydro denitrogenation,Poisoning by Coke deposit.

UNIT-III **9**
Heavy oil upgradation process - Carbon rejection, Hydrogen addition,Chemistry of upgrading. Upgrading Technologies-Hydrogen addition process,Thermal rearrangements and carbon rejection.

UNIT-IV **9**
Instability of incompatibility of Petroleum processes -Distilled Products-Influence of heteroatom function Oxygen, Sulphur, Nitrogen species.

UNIT-V **9**

Petroleum analysis and evaluations - Separation by molecular weight and molecular type -ASTM Evaluation,Carbon residue,Metal content,Viscosity,Density,Specific gravity,Volatility - Spectroscopic method-infrared,Nuclear,Magnetic resonance,Mass Spectrometry

TOTAL 45: PERRIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Know about the preparation and structures of hydrocarbons.

CO2: Understand the cracking mechanisms and techniques.

CO3: Know about Chemistry behind the upgradation process.

CO4: Know about the influence of hetero atoms in petroleum products

CO5: Understand the petroleum evaluation techniques and methods.

TEXT BOOK:

1. Speight, J.G., Petroleum chemistry and refining Taylor and Francis, London,2015.

REFERENCE

1. Speight, J.G The Chemistry and Technology of Petroleum,Marcel Dekker,New York 2014.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Know about the preparation and structures of hydrocarbons.	3	-	-	-	2	-	-	-	-	2	1	-	3	-	2	-
CO2	Understand the cracking mechanisms and techniques.	3	-	-	-	2	-	-	-	-	-	-	-	2	-	3	-
CO3	Know about Chemistry behind the upgradation process.	3	-	-	-	2	-	-	-	-	1	-	-	3	-	2	-
CO4	Know about the influence of hetero atoms in petroleum products.	3	-	-	-	3	-	-	-	-	-	1	-	2	-	3	-
CO5	Understand the petroleum evaluation techniques and methods.	3	-	2	-	3	-	-	-	-	1	-	-	3	-	2	-
Overall CO		3	-	2	-	2	-	-	-	-	1	1	-	3	-	2	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5016 **OIL AND GAS WELL TESTING** **L T P C**
3 0 0 3

OBJECTIVE

The course is aimed to

- To learn about fluid flow characteristics.
- To gain knowledge on analysis of well tests data.
- To gain knowledge on DST studies.
- To analyse well test using curves.
- To learn about gas well tests.

UNIT I **9**

Principles of Fluid Flow for steady state, semi steady state & unsteady state conditions. Diffusivity Equation Derivation & Solutions, Radius of investigation, principle of superposition, Horner's approximation.

UNIT II **9**

Pressure Transient Tests: Drawdown and build up-test analysis, determination of permeability and skin factor, Analysis of pressure-build-up tests distorted by phase redistribution, Well-test interpretation in hydraulically fractured wells, Interpretation of well-test data in naturally fractured reservoirs, Wellbore effects, Multilayer reservoirs, Injection well testing, Multiple well testing, Wireline formation testing. Wireline while drilling formation testing. Interference testing, Pulse testing,

UNIT III **9**

Drill Stem Testing: Equipment, DST chart observation and preliminary interpretation. Well preparation for testing, Multiple well testing. Effect of reservoir heterogeneities & Well bore conditions, fractured reservoir application.

UNIT IV **9**

Well-test analysis by use of type curves: Fundamentals of type curves, Ramey's type curve, McKinleTy's and Gringarten et al type curves.

UNIT V **9**

Gas well testing: Basic theory of gas flow in reservoir, Flow-after-flow test, Isochronal test, etc.

TOTAL :45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the basic concepts and various principles of fluid flow and superposition.

CO2: Understand the various experiments on wells and data analysis.

CO3: Know the equipment used for DST and its characterization.

CO4: Understand the different types of curves for well tests.

CO5: Understand the basic concepts of gas well testing.

TEXT BOOK

1. Oil Well Testing Handbook Amanat U. Chaudhry (2004)
2. Gas Well Testing Handbook Amanat U. Chaudhry (2003)

REFERENCE

1. Well Testing by John Lee (2017)

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the basic concepts and various principles of fluid flow and superposition	2	3	2	-	2	-	-	-	3	2	-	-	3	-	2	-
CO2	Understand the various experiments on wells and data analysis.	-	2	3	2	3	-	-	-	2	3	-	-	3	2	3	-
CO3	Know the equipment used for DST and its characterization.	2	3	2	3	2	-	-	-	3	2	-	-	3	3	2	-
CO4	Understand the different types of curves for well tests.	-	2	3	2	3	-	-	-	2	3	-	-	3	2	3	-
CO5	Understand the basic concepts of gas well testing.	-	3	2	3	2	-	-	-	3	2	-	-	3	3	2	-
Overall CO		2	3	2	3	2	-	-	-	3	2	-	-	3	3	2	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5017 **OFFSHORE DRILLING AND PRODUCTION PRACTICES** **L T P C**
3 0 0 3

OBJECTIVE

The course is aimed to

- To learn about the important aspects of offshore structural design.
- To know about description and operation techniques.
- To understand about the types and installation.
- To learn about offshore drilling platforms.
- To understand about the offshore production and storage.

UNIT I **9**

Introduction to offshore oil and gas operations-Sea States and Weather-Meteorology, oceanography, ice, sea bed soil.

UNIT II **9**

Buoyancy and stability-Offshore Fixed Platforms: Types, description and operations.

UNIT III **9**

Offshore Mobile Units: Types, description and installation-Station keeping methods like conventional mooring and dynamic positioning system.

UNIT IV **9**

Offshore Drilling-Difference in drilling from land, from fixed platform, jack up, ships and semi submersibles-Use of conductors and risers-Deep sea drilling-Offshore Well Completion- Platforms and subsea completions-Deep water applications of subsea technology.

UNIT V **9**

Offshore Production: Oil processing platforms, gas processing platforms, water injection platforms, storage, SPM and SBM, transportation and utilities-Deep water technology: Introduction, definition & prospects-Deep water regions-Deep water drilling rig: selection and deployment-Deep water production system-Emerging deep-water technologies: special equipment and systems, Remote operation vessels (ROV).

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Know about basic concepts of offshore drilling.
CO2: Know about the off-shore platforms.
CO3: Know about the installation of equipment.
CO4: Gain Knowledge about the subsea technologies.
CO5: Learn the equipment involved in the Production practices.

REFRENCES:

1. Handbook of Offshore Engineering by Subrata K. Chakrabarti (2005).

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Know about basic concepts of offshore drilling.	3	-	-	-	3	2	3	3	-	-	-	-	3	-	-	-
CO2	Know about the off-shore platforms.	3	-	-	2	2	3	-	2	-	-	-	-	3	-	2	-
CO3	Know about the installation of equipment.	3	-	3	-	3	2	2	3	-	-	-	-	3	1	-	-
CO4	Gain Knowledge about the subsea technologies.	3	-	2	3	2	3	3	2	-	-	-	-	3	-	-	-
CO5	Learn the equipment involved in the Production practices.	2	-	3	2	3	2	2	3	-	-	-	-	3	-	-	-
Overall CO		3	-	3	2	3	2	3	3	-	-	-	-	3	1	2	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5018 **RESERVOIR CHARACTERIZATION AND MODELLING** **L T P C**
3 0 0 3

OBJECTIVE:

The course is aimed to

- To know about the reservoir characterization and modelling.
- To learn about the recognition and well log techniques.
- To learn about seismic survey techniques
- To learn about the reservoir characteristics and behaviour
- To learn workstations and Software's used in reservoir characterization and modeling

UNIT I **9**

Overview of reservoir characterization and modeling problems. Reservoir mapping.3D modeling. Univariate, bivariate and multivariate statistics for geological data analysis**.**

UNIT II **9**

Pattern recognition techniques. Petrophysical predictions from well logs. Introduction to petroleum geostatistics. Variograms. Kringin. Uncertainty quantification. Finite difference approximations to the diffusivity equation and the application of those approximations for reservoir simulations

UNIT III **9**

Stochastic reservoir modeling. Sequential simulation. Gaussian simulation. Indicator simulation. Integrating seismic attributes, well tests and production data. Constraining reservoir models with various sources of information. Reservoir up girding and upscaling.

UNIT IV **9**

Reservoir simulation – Investigation of petroleum reservoir characteristics and behavior, including: pore volume, fluid distribution and movement, and recovery. optimized field development and management plans.

UNIT V **9**

Workstations and Software's used in reservoir characterization and modeling. Seismic reservoir characterization - AVO Reservoir Characterization. Correlation and Petrophysical analysis. Practical use of reservoir simulation.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Know about the reservoir modelling and geological data

CO2: Gain the knowledge about well logging

CO3: Work on reservoir simulation.

CO4: Know about the behaviour and characteristics of petroleum reservoirs.

CO5: Know about the software used for the reservoir modelling.

TEXT BOOK:

1. Petroleum Exploration Hand Book by Moody, G.B. McGraw-Hill Inc (2010).
2. Wellsite Geological Techniques for petroleum Exploration by Shay's et al (1988).

REFERENCE:

1. Standard Hand Book of Petroleum & Natural Gas Engineering" – 2nd Edition 2005-William C.L Yons& Gary J.Plisga-Gulf professional publishing comp (Elsevier).

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Know about the reservoir modelling and geological data.	3	-	-	-	2	-	-	-	-	-	-	-	3	2	3	-
CO2	Gain the knowledge about well logging.	3	-	3	2	3	-	-	-	-	-	-	-	3	3	2	-
CO3	Work on reservoir simulation.	3	-	2	2	-	-	-	-	-	-	-	-	3	2	2	-
CO4	Know about the behaviour and characteristics of petroleum reservoirs.	3	-	3	2	2	-	-	-	-	-	-	-	3	3	2	-
CO5	Know about the software used for the reservoir modelling.	2	-	2	3	3	-	-	-	-	-	-	-	3	2	3	-
Overall CO		3	-	3	2	3	-	-	-	-	-	-	-	3	2	2	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5019 INTEGRATED OIL AND GAS RESERVOIR MANAGEMENT LT P C
3 0 0 3

OBJECTIVE:

The course is aimed to

- To know about fundamentals of management concepts.
- To gain a knowledge on reservoir management and its applications.
- To learn about reservoir model in gas reservoir management.
- To gain knowledge on various mathematical techniques.
- To know about risk evaluation and uncertainties in reservoir management.

UNIT I **9**

Introduction-Scope and Objectives-Reservoir management concepts: Definition and history-Fundamentals of reservoir management, synergy and team-Integration of geosciences and engineering- Integration of exploration and development technology

UNIT II **9**

Reservoir management process-Setting goals, developing plans and economics, surveillance and monitoring, evaluation Data acquisition, analysis and management-Classification of data, acquisition, analysis and application, validation, storing and retrieval

UNIT III **9**

Reservoir model-Role of reservoir model in reservoir management-Integration of G & G and reservoir model.

UNIT IV **9**

Reservoir performance analysis and prediction-Naturally producing mechanism, reserves and role of various forecasting tools- Volumetric method, MBE, Decline curve and mathematical simulation

UNIT V **9**

Matured field reservoir Management-Reservoir Management Economics-Evaluation, risk and uncertainties Reservoir management plans-Strategy for newly developed field, Secondary and EOR operated field.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the basic concepts of reservoir management and developmental studies.
CO2: Understand the data classification and application of reservoir management process.
CO3: Know about the gas reservoir model and integration.
CO4: Understand the mathematical simulation reservoir performance.
CO5: Do the cost value for newly developed fields through reservoir management plans.

REFERENCE

1. Hydrocarbon Exploration and Production by Frank John.

TEXT BOOKS:

1. Katz D.L.et al., Natural Gas Engineering (Production & storage), McGraw-Hill, Singapore (1991).
2. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing (2004).
3. Mc.Cray. A.W and Cole.F.W. 'Oil Well Drilling Technology' University of Oklahoma Press, Norman (1981).

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the basic concepts of reservoir management and developmental studies.	3	-	-	3	3	-	-	2	-	-	3	-	3	-	2	-
CO2	Understand the data classification and application of reservoir management process.	2	-	3	2	2	-	-	3	-	-	2	-	3	2	2	-
CO3	Know about the gas reservoir model and integration.	3	3	-	2	3	-	-	2	-	-	3	-	3	3	-	-
CO4	Understand the mathematical simulation reservoir performance	2	-	-	3	2	-	-	3	-	-	3	-	2	2	3	-
CO5	Do the cost value for newly developed fields through reservoir management plans.	2	3	2	2	3	-	-	2	-	-	2	-	3	2	2	-
Overall CO		2	3	3	2	3	-	-	2	-	-	3	-	3	2	2	-

1, 2 and 3 are correlation levels with weightingsas Slight (Low), Moderate (Medium) and Substantial (High) respectively

AS5020 **PETROLEUM ECONOMICS** **LT P C**
3 0 0 3

OBJECTIVE:

The course is aimed to

- To learn about the supply and demands of the petroleum products
- To study about the oil and gas markets
- To study about the evaluation of the petroleum projects and important parameters.
- To know about the petroleum exploration and contracts.
- To learn about the economics case studies in oil industries

UNIT I **9**

Supply and demand curves, the elasticity of supply and demand, public finance concepts such as consumer surplus, excise and export taxes. Forecasting techniques for the energy industry, including energy prices. Demand and supply for natural gas, cured oil and pipeline transportation, determinants of energy demand, energy markets, energy pricing, stability and performance of energy markets.

UNIT II **9**

The economics of investment, Discounted cash flow analysis, Cost Benefit Analyses, Internal Rate of Return, NPV, Profitability Index, Natural Monopoly theory, National competition Policy, Gas Market Regulation, taxation of the oil and gas industry, government policy and trade permits, Monte Carlo analysis, Net Back Pricing, Transfer Pricing and regulatory aspects.

UNIT III **9**

Application of petroleum engineering principles and economics to the evaluation of oil and gas projects, evaluation principles, time value of money concepts, investment measures, cost estimation, price and production forecasting, risk and uncertainty, project selection and capital budgeting inflation, escalation, operating costs, depreciation, cost recovery

UNIT IV **9**

Petroleum exploration and production contracts. Sharing of the economic rent, portfolio management. Value creation, corporate finance & return on capital, economic appraisal methods for oil filed development, reservoir model costs and calculations.

UNIT V **9**

Case studies: Economic study of an oil filed development project, petrochemical plant project, natural gas break-even price, natural gas liquefaction cost, LGN transport cost, investment profitability study for a gas pipeline.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Integrate knowledge on financial statements, Depreciation and Accounting.
CO2: Gain Knowledge about the oil and gas marketing, oil and gas market circulations
CO3: Understand the concept of economics in a process plant, time value of money and cost indices
CO4: Understand the basics of exploration and about the various contracts in oil fields.
CO5: Do any kind of case study in the oil field.

TEXT BOOKS:

1. Industrial Economics – An Introductory Textbook. R.R.Barthwal, 2nd Edition, New Age International Publisher (2004).
2. Managerial Economics – D.N.Divedi. 6th Revised Edition. Vikas Publishing House Private Ltd (2006).
3. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary, C Plisga. Gulf Professional Publishing (2004).

REFERENCES:

1. Petroleum Engineering Handbook. Bradely, H.B. Society of Petroleum Engineers. Richardson. Texas (2006).
2. The Encyclopedia Americana, International Edition Volume 9, Grolier Incorporated (2002).

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Integrate knowledge on financial statements, Depreciation and Accounting.	3	-	3	-	2	3	-	3	-	-	2	-	-	-	-	2
CO2	Gain Knowledge about the oil and gas marketing, oil and gas market circulations	2	-	-	2	-	2	-	2	-	-	3	-	2	-	-	3
CO3	Understand the concept of economics in a process plant, time value of money and cost indices	3	-	2	2	-	2	-	-	-	-	3	-	-	1	-	2
CO4	Understand the basics of exploration and about the various contracts in oil fields.	2	-	-	-	2	-	-	3	-	-	2	-	-	-	-	3
CO5	Do any kind of case study in the oil field.	2	-	2	-	-	3	-	2	-	-	3	-	-	-	-	2
Overall CO		2	-	2	2	2	3	-	3	-	-	3	-	2	1	-	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

IB5073 **CHEMICAL REACTION ENGINEERING** **L T P C**
3 1 0 4

OBJECTIVES

The course is aimed to

- To gain knowledge about chemical kinetics of homogeneous reactions.
- To obtain knowledge about to performance equations for ideal reactors.
- To understand the design of reactor for multiple reactions.
- To study about the residence time distribution function and analyze the non-ideality in the reactor.
- To Understand the gas solid catalytic reaction and their mechanism

UNIT I CHEMICAL KINETICS AND IDEAL REACTORS 12

Rate equation, elementary, non-elementary reactions, theories of reaction rate and Prediction; Design equation for constant and variable volume batch reactors, Design of continuous reactors - stirred tank and tubular flow reactor

UNIT II DESIGN FOR MULTIPLE REACTIONS 12

Design of reactors for multiple reactions - consecutive, parallel and mixed reactions - factors affecting choice, optimum yield and conversion, selectivity, reactivity and yield. Recycle reactor, size comparison of reactors.

UNIT III TEMPERATURE AND PRESSURE EFFECTS 12

Non-isothermal homogeneous reactor systems, adiabatic reactors, rates of heat exchanges for different reactors, design for constant rate input and constant heat transfer coefficient, operation of batch and continuous reactors, optimum temperature progression.

UNIT IV BASICS OF NON-IDEAL FLOW 12

The residence time distribution as a factor of performance; residence time functions and relationship between them in reactor; basic models for non-ideal flow; conversion in non-ideal reactors

UNIT V HETEROGENEOUS CATALYTIC AND NON-CATALYTIC REACTIONS 12

Catalysis and adsorption Gas solid catalytic reaction: steps in catalytic reaction, Single site, dual site mechanisms, Langmuir Hinshelwood, EleyRideal, Rate controlling steps. Experimental methods for determining rate, differential, integral reactor and reactor deign. Fluid solid non-catalytic reactions. rate controlling steps; time for complete conversion for single and mixed sizes, fluidized and static reactors. Kinetics of fluid –fluid reactions, Absorption combined with chemical reactions; mass transfer coefficients and kinetic constants;

TOTAL : 60 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the kinetics of homogenous reaction.

CO2: Develop performance equation and determine the conversion for different reactors.

CO3: Understand the reactor arrangement in series and parallel configuration.

CO4: Understand the basic of non - ideal flow

CO5: Understand the concepts of effectiveness factor, Thiele modulus and Design of catalytic reactor for gas solid reaction.

TEXT BOOKS

1. Levenspiel O, “Chemical Reaction Engineering”, Wiley Eastern Ltd., II Edition, 2000.
2. Smith, J.M, “Chemical Engineering Kinetics”, McGraw Hill, III Edition, 1981.
3. Fogler.H.S., “Elements of Chemical Reaction Engineering”, Prentice Hall of India Ltd., 4th Edition, 2005.

REFERENCE

1. Froment. G.F. &K.B.Bischoff, “Chemical Reactor Analysis and Design”, II Edition, Wiley New York, (2011).

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the kinetics of homogenous reaction.	3	2	2	2	-	-	-	-	-	-	-	-	3	-	-	-
CO2	Develop performance equation and determine the conversion for different reactors.	2	3	3	3	-	-	-	-	-	-	-	-	2	-	-	2
CO3	Understand the reactor arrangement in series and parallel configuration.	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	Understand the basic of non - ideal flow.	3	2	-	3	-	-	-	-	-	-	-	-	2	-	-	3
CO5	Understand the concepts of effectiveness factor, Thiele modulus and Design of catalytic reactor for gas solid reaction.	2	3	-	2	-	-	-	-	-	-	-	-	3	-	-	-
Overall CO		3	3	2	3	-	-	-	-	-	-	-	-	3	-	-	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5021 **PETROLEUM CORROSION TECHNOLOGY** **LT P C**
3 0 0 3

OBJECTIVES:

The course is aimed to

- To know about the basic corrosion principles.
- To understand the types of corrosion found in the petroleum industries.
- To gain knowledge on corrosion in oil fields.
- To learn about corrosion prevention methods and its applications.
- To understand the various treatment process on oil/gas pipelines.

UNIT I **9**

Introduction to corrosion control. Definitions - Materials involved - Basic corrosion principles - corrosion rate. Electrochemical reactions. Electrode potentials – passivity – temperature – pressure – velocity – conductivity - pH - dissolved gases. Corrosion in oil and gas production.

UNIT II **9**

Forms of corrosion – uniform corrosion – Pitting - Galvanic corrosion - Intergranular and weld corrosion - Selective Leaching - Stress corrosion. Impingement - Hydrogen embrittlement – Corrosion fatigue.

UNIT III **9**

Role of oxygen in oil filed corrosion- down hole and surface equipment - water flood. Removal of oxygen, analysis and criteria for control. Role of carbon dioxide (CO_2) in corrosion-Effect of temperature and pressure - Corrosion of well tubing and other equipment. Role of hydrogen sulphide (H_2S)-Corrosion in downhole, surface, storage and pipelines.

UNIT IV **9**

Corrosion prevention methods - Principles of operation and applications systems. Cathodic protection – Galvanic systems - Corrosion prevention coatings- Corrosion prevention inhibitors- types of corrosion inhibitors- Inhibitor selection and injection.

UNIT V **9**

Inspection and corrosion monitoring. Oil treatment corrosion - crude oil properties - desalting-sweetening processes. Corrosion in oil storage tank corrosion- oilfield and oil treating facilities-oil/ gas pipelines -offshore platforms- subsea systems.

TOTAL: 45 PERIODS

COURSE OUTCOME:

On completion of the course students are expected to

CO1: Understand the basic concepts of corrosion involved and its various parameters.

CO2: Know the various types of corrosion in petroleum processes.

CO3: Gain knowledge on removal techniques of various gases.

CO4: Understand the principle of operation and applications.

CO5: Identify and define the various types of petroleum corrosion and prevention technologies.

TEXT BOOKS:

1. "Corrosion control in Petroleum production"-TPC 5-2-nd edition H.G.Byars NACE International, 1999.
2. Chemical engineering series, Coulson and Richardson, Mc Graw Hill Publications (1991).

REFERENCE:

1. Standard Handbook of Petroleum and Natural Gas Engineering. 3rd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing (2015).

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the basic concepts of corrosion involved and its various parameters.	3	-	-	3	3	2	-	-	-	-	-	-	2	-	-	3
CO2	Know the various types of corrosion in petroleum processes.	2	-	-	3	2	2	-	-	-	-	-	-	2	-	-	2
CO3	Gain knowledge on removal techniques of various gases.	3	-	-	2	2	-	-	-	-	-	-	-	2	-	3	2
CO4	Understand the principle of operation and applications.	2	-	3	3	2	2	2	-	-	-	-	-	2	-	2	-
CO5	Identify and define the various types of petroleum corrosion and prevention technologies.	2	-	-	2	3	2	3	2	-	-	-	-	2	-	-	2
Overall CO		2	-	3	2	2	2	3	2	-	-	-	-	2	-	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5022 **REFINERY PROCESS DESIGN** **L T P C**
3 0 0 3

OBJECTIVE

The course is aimed to

- To understand the concepts behind the multicomponent distillation
- To learn about the Distillation process in Refineries
- To learn about the various columns used in industries.
- To study about the furnace and its types.
- To study the concepts in pumps and compressors

UNIT I MULTICOMPONENT DISTILLATION 9

Dew point and bubble point for multi component mixtures. Design of multi component distillation column, Number of variables, Selection of key components, Selection of column pressure, Feed condition, Plate-to-plate calculations, Empirical short cut methods, Introduction to rigorous solution procedures.

UNIT II PETROLEUM REFINERY DISTILLATION 9

TBP, EFV, ASTM distillation curves and their relevance, Material balance and flash zone calculations for petroleum refinery distillation columns, Pump around and pump back calculations, Overall energy requirements, Estimation of number of equilibrium stages, Design using Packie charts and Watkins method, Introduction to rigorous solution procedure based on pseudo components.

UNIT III COLUMN DESIGN 9

Process design of distillation towers. Flooding charts. Trays and packings. Vacuum devices. Pressure drops. Height,diameter,supports.Piping requirements. Aspects of mechanical design. A typical P&ID for a distillation column.

UNIT IV FIRED HEATERS 9

Heat load calculations for furnace heaters used in crude refining, Basic constructional features,Different furnace types, Review of factors to be considered in the design of fired heaters, Introduction to manual calculations methods.

UNIT V PUMPS AND COMPRESSORS 9

Types of pumps and compressors. Selection criteria. Power rating calculations based on process duty.Use of operating curves of centrifugal pump. NPSHR and NPSHA. Pump Cavitation. Surge problem in compressors.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Know the concept of multicomponent distillation in design.

CO2: Know about the distillation columns and their design methods.

CO3: Understand about the packing types.

CO4: Understand about the furnace and their types used in refineries

CO5: Know the concept behind pumps and compressors and their selection criteria.

TEXT BOOKS

1. Van Winkle M., “Distillation”, McGraw Hill, 1967.
2. Watkins, “Petroleum Refinery Distillation”, McGraw Hill, 1993
3. Sinnott R. K., “Coulson and Richardson’s Chemical engineering”, Vol. 6, III Edition, Butter Worth-Heinemann, 1999.
4. Kern D. Q., “Process Heat Transfer”, McGraw Hill, 1999.
5. Cao Eduardo,” Heat Transfer in Process Engineering”, McGraw Hill,2010

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Know the concept of multicomponent distillation in design.	3	2	3	2	3	-	-	-	-	-	1	-	2	-	-	2
CO2	Know about the distillation columns and their design methods.	3	-	2	2	2	-	-	-	-	-	-	-	2	-	-	2
CO3	Understand about the packing types.	-	2	3	-	3	-	-	-	-	-	-	-	2	-	-	3
CO4	Understand about the furnace and their types used in refineries.	3	-	2	2	-	-	-	-	-	-	2	-	2	-	-	3
CO5	Know the concept behind pumps and compressors and their selection criteria.	2	2	2	-	2	-	-	-	-	-	-	-	2	-	-	2
Overall CO		3	2	2	2	3	-	-	-	-	-	2	-	2	-	-	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5023 **PRODUCT DESIGN AND DEVELOPMENT FOR PETROCHEMICAL ENGINEERS** **L T P C 3 0 0 3**

OBJECTIVE

The course is aimed to

- To understand about basic concepts behind the product design.
- To know the concept behind the selection and testing of the design.
- To learn about the product architecture.
- To know about the Industrial design.
- To understand the manufacturing design.

UNIT I INTRODUCTION **9**

Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement.

UNIT II CONCEPT GENERATION, SELECTION AND TESTING **9**

Plan and establish product specifications. Task - Structured approaches - clarification - search externally and internally-Explore systematically - reflect on the solutions and processes - concept selection - methodology - benefits. Implications - Product change - variety – component standardization - product performance – manufacturability.

UNIT III PRODUCT ARCHITECTURE **9**

Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

UNIT IV INDUSTRIAL DESIGN **9**

Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design-impact – design process - investigation of customer needs - conceptualization - refinement - management of the industrial design process.

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT **9**

Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping – Planning for prototypes - Economic Analysis.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Know the basic concepts and importance of product design.
CO2: Understand the planning, selection criteria of the design and products.
CO3: Gain knowledge about the product management and architecture.
CO4: Understand the industrial design and tools for designs.
CO5: Understand the economic analysis of the design.

TEXT BOOK

1. Ulrich K.T. and Eppinger S.D., “Product Design and Development” McGraw – Hill International Editions,1999.

Attested

REFERENCES

1. Belz A., 36-Hour Course: “Product Development” McGraw-Hill, 2010.
2. Rosenthal S., “Effective Product Design and Development”, Business One Orwin, Homewood, 1992, ISBN 1-55623-603-4.
3. Pugh S., “Total Design – Integrated Methods for successful Product Engineering”, Addison Wesley Publishing, 1991, ISBN 0-202-41639-5

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Know the basic concepts and importance of product design.	3	3	2	2	-	-	-	-	-	-	-	-	3	-	-	2
CO2	Understand the planning, selection criteria of the design and products.	3	2	3	2	2	-	-	-	-	-	-	-	3	-	-	3
CO3	Gain knowledge about the product management and architecture.	3	3	2	2	2	-	-	-	-	-	-	-	3	-	-	2
CO4	Understand the industrial design and tools for designs.	2	2	3	3	3	-	-	-	-	-	-	-	3	-	-	3
CO5	Understand the economic analysis of the design.	2	2	3	2	2	-	-	-	-	-	-	-	2	-	-	2
Overall CO		3	2	3	2	2	-	-	-	-	-	-	-	3	-	-	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5024 UNCONVENTIONAL HYDROCARBON SOURCES LT P C
3 0 0 3

OBJECTIVES

The course is aimed to

- To understand the geographic distribution of unconventional hydrocarbon resources
- To understand characterization of source and reservoir rocks
- To understand methodology to produce these reserves
- To understand environmental consequences of producing these reserves
- Demonstrate awareness related to environmental issues involved in the development of non-conventional hydrocarbon resources.

UNIT I NON-CONVENTIONAL OIL: 9

Continuous Accumulation System

Introduction, geology of Heavy oil, extra heavy oil, Tar Sand and bituminous, oil shales, theirorigin and occurrence worldwide, resources, reservoir characteristics, new production technologies.

UNIT II SHALE GAS/ OIL RESERVOIR 9

Introduction to shale gas & basin centered gas, tight reservoirs.Shale gas geology, important occurrences in India, petrophysical properties, Development ofshale gas, design of hydro fracturing job, horizontal wells, production profiles.

UNIT III COAL BED METHANE 9

Formation and properties of coal bed methane. Thermodynamics of coal bed methane.Exploration and Evaluation of CBM.Hydro-fracturing of coal seam. Production installation and surface facilities. Well operationsand production equipment.

UNIT IV GAS HYDRATES 9

Introduction & present status of gas hydrates. Formation and properties of gas hydrates, Thermodynamics of gas hydrates. Recovery methods.Prevention & control of gas hydrates, Gas hydrates accumulation in porous medium. Gasextraction from gas hydrates.

UNIT V COAL AND GAS CONVERSION TO OIL 9

Introduction, classification and principles, pyrolysis, theoretical aspect of processes involvedin conversion.Technological development of direct conversion and indirect processes and sustainability ofconversions

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Recognize and apply the concept of continuous accumulation system.

CO2: Apply the concepts related to exploration and development of Shale Gas Reservoirs.

CO3: Apply the concepts related to exploration and development of Coal Bed Methane.

CO4: Understand the formation of gas hydrates.

CO5: Apply different conversion processes for the production of Hydrocarbons.

REFERENCE BOOKS

1. Carrol John, 2003, Natural Gas Hydrates: A guide for engineers, Gulf Publications.
2. Farooqi Ali, S M, Jones S A and Meldau R F, Practical Heavy Oil Recovery, SPE, 1997.
3. James T. Bartis, Frank Camm, David S. Ortiz, Producing Liquid Fuels from Coal, Prospects and Policy Issues. NETL, DOE, USA, 2008.
4. Warner, H.R., 2009, Emerging and Peripheral Technologies, Society of Petroleum Engineers, Handbook, Volume VI.
5. Pramod Thakur, Steve Schatzel and KashyAminian, (Editors), 2014, Coal Bed Methane: From Prospects to Pipeline, Elsevier,
6. Rafiqul Islam, M, 2014, Unconventional Gas Reservoirs: Evaluation, Appraisal, and Development, Gulf Professional Publishing.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Recognize and apply the concept of continuous accumulation system.	3	-	-	3	-	-	3	-	-	-	-	-	3	-	-	2
CO2	Apply the concepts related to exploration and development of Shale Gas Reservoirs.	2	-	-	2	-	3	2	-	-	-	-	-	3	-	-	3
CO3	Apply the concepts related to exploration and development of Coal Bed Methane.	3	-	-	3	-	2	2	-	-	-	-	-	3	-	-	3
CO4	Understand the formation of gas hydrates.	3	-	-	2	-	3	3	-	-	-	-	-	3	-	-	2
CO5	Apply different conversion processes for the production of Hydrocarbons.	2	-	-	3	-	-	2	-	-	-	-	-	2	-	-	3
Overall CO		3	-	-	3	-	3	2	-	-	-	-	-	3	-	-	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5025 DESIGN OF PRESSURE VESSEL AND PIPING L T P C
3 0 0 3

OBJECTIVES

The course is aimed to

- To determine the stresses and its applications.
- To know the types of pressure vessels.
- To know about the designing of vessels.
- To learn about buckling phenomenon.
- To understand the design procedure of pressure vessels and the piping layout.

UNIT I DETERMINATION OF STRESS 3

Methods for determining stresses – Terminology and Ligament Efficiency – Applications.

UNIT II STRESSES IN PRESSURE VESSELS 15

Introduction – Stresses in a circular ring, cylinder – Membrane stress Analysis of Vessel Shell components – Cylindrical shells, spherical Heads, conical heads – Thermal Stresses – Discontinuity stresses in pressure vessels.

UNIT III DESIGN OF VESSELS 15

Design of Tall cylindrical self-supporting process columns –Supports for short, vertical and horizontal vessels – stress concentration – at a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of Reinforcement – pressure vessel Design. Introduction to ASME pressure vessel codes

UNIT IV BUCKLING OF VESSELS 8

Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

UNIT V PIPING 4

Introduction – Flow diagram – piping layout and piping stress Analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Predict the stresses in pressure vessels.

CO2: Gain knowledge on vessel design.

CO3: Know about the vessel buckling and its phenomenon.

CO4: Get familiarized with the various theories and practices on pressure vessel and piping design

CO5: Solve the industrial practical problems in the field of pressure vessel design.

REFERENCES

1. John F. Harvey, Theory and Design of Pressure Vessels, CBS Publishers and Distributors, 1987.
2. Henry H. Bedner, “Pressure Vessels, Design Hand Book, CBS publishers and Distributors, 1987.
3. Stanley, M. Wales, “Chemical process equipment, selection and Design. Buterworths series in Chemical Engineering, 1988 .
4. William. J., Bees, “Approximate Methods in the Design and Analysis of Pressure Vessels and Piping”, Pre ASME Pressure Vessels and Piping Conference, 1997.

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Predict the stresses in pressure vessels.	3	3	2	-	2	-	-	-	-	-	-	-	3	-	-	2
CO2	Gain knowledge on vessel design.	2	2	2	-	3	-	-	-	-	-	-	-	2	-	-	2
CO3	Know about the vessel buckling and its phenomenon.	-	3	-	3	2	-	-	-	-	-	-	-	3	-	-	-
CO4	Get familiarized with the various theories and practices on pressure vessel and piping design.	-	3	2	-	3	-	-	-	-	-	-	-	-	-	-	2
CO5	Solve the industrial practical problems in the field of pressure vessel design. .	-	2	3	3	2	-	-	-	-	-	-	-	3	-	-	3
Overall CO		3	3	2	3	2	-	-	-	-	-	-	-	3	-	-	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5026 SUPPLY CHAIN MANAGEMENT FOR PETROCHEMICAL ENGINEERS LT P C
3 0 0 3

OBJECTIVES

The course is aimed to

- To learn the basic concept of Supply Chain Management.
- To know about the Logistics Management.
- To learn the Network design in supply Design.
- To understand the sourcing and pricing concepts.
- To know the various technologies used in supply chains.

UNIT I INTRODUCTION 9

Definition of Logistics and SCM: Evolution, Scope, Importance& Decision Phases – Drivers of SC Performance and Obstacles

UNIT II LOGISTICS MANAGEMENT 9

Factors – Modes of Transportation - Design options for Transportation Networks-Routing and Scheduling – Inbound and outbound logistics- Reverse Logistics – 3PL- Integrated Logistics Concepts- Integrated Logistics Model – Activities - Measuring logistics cost and performance – Warehouse Management - Case Analysis

UNIT III SUPPLY CHAIN NETWORK DESIGN 9

Distribution in Supply Chain – Factors in Distribution network design –Design options-Network Design in Supply Chain – Framework for network Decisions - Managing cycle inventory and safety.

UNIT IV SOURCING, AND PRICING IN SUPPLY CHAIN 9

Supplier selection and Contracts - Design collaboration - Procurement process. Revenue management in supply chain

UNIT V COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN 9

Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work. E Business & SCM. Metrics for SC performance – Case Analysis

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand basic concepts of logistics and SCM

CO2: Know about the logistic management and analysis.

CO3: Know about the Distribution, Design and managing supply chain network.

CO4: Do the selection of supplier and contract through Revenue management.

CO5: Understand the technologies in supply chain.

REFERENCES

1. Supply Chain Management, Strategy, Planning, and operation – Sunil Chopra and Peter Meindl- PHI, 6th edition, (2016).
2. Logistics, David J.Bloomberg, Stephen Lemay and Joe B.Hanna, PHI 2002
3. Logistics and Supply Chain Management –Strategies for Reducing Cost and Improving Service. Martin Christopher, Pearson Education Asia, 5th Edition (2016).
4. Modeling the supply chain, Jeremy F.Shapiro, Thomson Duxbury, (2006).
5. Handbook of Supply chain management, James B.Ayers, St.Lucle Press, (2006).

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	. Understand basic concepts of logistics and SCM	3	-	2	-	2	2	-	-	-	-	3	-	1	2	-	-
CO2	Know about the logistic management and analysis.	2	3	3	-	2	2	-	-	-	-	2	-	-	-	3	3
CO3	Know about the Distribution, Design and managing supply chain network.	3	2	3	-	3	-	-	-	-	-	3	-	2	-	-	-
CO4	Do the selection of supplier and contract through Revenue management.	2	2	3	-	3	3	-	-	-	-	3	-	-	-	1	-
CO5	Understand the technologies in supply chain.	3	-	3	-	2	2	-	-	-	-	2	-	-	2	-	-
Overall CO		3	2	3	-	2	2	-	-	-	-	3	-	2	2	3	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5073 **PROCESS PLANT UTILITIES** **L T P C**
3 0 0 3

OBJECTIVES

The course is aimed to

- To understand the water as a plant utility
- To understand the use of steam in process plants.
- To know about the Refrigeration systems.
- To understand the compressor and their types.
- To understand the type of fuel used in chemical process industries.

UNIT I WATER **9**

Hard and Soft water, Requisites of Industrial Water and its uses. Methods of water Treatment such as Chemical Softening and Demineralization, Resins used for Water Softening and Reverse Osmosis. Effects of impure Boiler Feed Water.

UNIT II STEAM **9**

Properties of Steam, problems based on Steam, Types of Steam Generator such as Solid Fuel Fired Boiler, Waste Gas Fired Boiler and Fluidized Bed Boiler. Scaling and Trouble Shooting. Steam Traps and Accessories.

UNIT III REFRIGERATION **9**

Refrigeration Cycles, Methods of Refrigeration used in Industry and Different Types of Refrigerants such as Monochlorodifluro Methane, Chlorofluro Carbons and Brines. Refrigerating Effects and Liquefaction Processes.

UNIT IV COMPRESSORS AND COOLING TOWERS **9**

Classification of Compressor, Reciprocating Compressor, Single Stage and Two Stage Compressor, Velocity Diagram for Centrifugal Compressor, Slip Factor, Impeller Blade Shape. Properties of Air –Water Vapors and use of Humidity Chart. Equipment's used for Humidification, Dehumidification and Cooling Towers.

UNIT V FUEL AND WASTE DISPOSAL **9**

Types of Fuel used in Chemical Process Industries for Power Generation such as Natural Gas, Liquid Petroleum Fuels, Coal and Coke. Internal Combustion Engine, Petrol and Diesel Engine. Waste Disposal.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Know the chemical water treatment and use of industrial water.

CO2: Understand the properties of steam and steam generators types.

CO3: Know about the method of refrigeration used in industries and types of refrigerants.

CO4: Know about the classification and types of refrigeration systems.

CO5: Know about the Types of fuels used in industries and waste disposal.

TEXT BOOKS

1. Perry R. H. Green D. W. "Perry's chemical Engineer's Handbook", McGraw Hill, New York, 2008.

Attested

REFERENCES

1. W.Eckenfelder.Jr. "Industrial Water Pollution Control" 3rd edition, McGraw-Hill: New York, (2014).
2. P. L. Ballaney, "Thermal Engineering",24th edition, Khanna Publisher New Delhi, 2011.
3. P. N. Ananthanarayan, "Basic Refrigeration & Air conditioning", 4th edition, Tata McGraw Hill, New Delhi, 2013.

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Know the chemical water treatment and use of industrial water.	3	-	-	3	3	-	-	-	-	-	1	-	2	1	-	-
CO2	Understand the properties of steam and steam generators types.	2	-	-	2	2	-	-	-	-	-	-	-	-	-	1	-
CO3	Know about the method of refrigeration used in industries and types of refrigerants.	3	-	2	3	-	-	-	-	-	-	-	-	2	-	-	1
CO4	Know about the classification and types of refrigeration systems.	2	-	-	2	3	-	-	-	-	-	-	-	-	-	-	-
CO5	Know about the Types of fuels used in industries and waste disposal.	3	-	-	-	2	-	-	-	-	-	-	-	-	2	-	-
Overall CO		3	-	2	3	3	-	-	-	-	-	1	-	2	2	1	1

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5027 **PLANT SAFETY AND RISK ANALYSIS** **L T P C**
3 0 0 3

OBJECTIVES

The course is aimed to

- To understand the need of safety in industries.
- To understand the safety regulations.
- To identify the hazards in the process plants.
- To Know about safety audit
- To understand the risk analysis techniques.

UNIT I NEED FOR SAFETY IN INDUSTRIES 9

Importance & objectives of safety- Safety Programmes – components and realization; Potential hazards – extreme operating conditions, toxic chemicals; safe handling

UNIT II PLANT SAFETY AND SAFETY REGULATION 9

Implementation of safety procedures – periodic inspection and replacement; Accidents - identification and prevention; Criteria for setting & layout of chemical plant, Factories Act and Safety Regulations.

UNIT III PLANT HAZARDS & RISK ANALYSIS 9

Fire hazards- Chemical hazards, Toxic hazards, Explosion hazards, Electrical hazards, Mechanical hazards, Radiation hazards, Noise hazards-Overall risk analysis--emergency planning-on site & off site emergency planning, risk management ISO 14000, EMS models case studies. Quantitative risk assessment - rapid and comprehensive risk analysis; Risk due to Radiation, explosion due to over pressure, jet fire-fire ball.

UNIT IV SAFETY AUDIT 9

Objective of safety audit- Hazard identification safety audits, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazan past accident analysis Fixborough-Mexico-Madras-Vizag Bopal analysis

UNIT V RISK ANALYSIS TECHNIQUES9

Hazard & Operability (HAZOP) studies- Hazard Analysis (HAZAN)-Fault Tree Analysis Consequence Analysis.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the importance of safety and its objectives.

CO2: Understand the implementation of safety and identification and prevention of Accidents.

CO3: Know about the types of hazards, emergency plan and ISO standards for safety studies.

CO4: Do the safety audit in plants.

CO5: Do the risk analysis in industries using the various techniques.

TEXT BOOKS

1. Chemical Process Safety: Fundamentals with Applications, Daniel A. Crowl, J.F. Louvar, Prantice Hall, NJ, 1990.
2. Fawatt, H.H. and Wood, W.S., “Safety and Accident Prevention in Chemical Operation“, Wiley Interscience, 1965.
3. Marcel, V.C., Major Chemical Hazard- Ellis Harwood Ltd., Chi Chester, UK, 1987. 4. Hyatt, N., Guidelines for process hazards analysis, hazards identification & risk analysis, Dyadem Press, 2004

REFERENCES

1. Handley, W., “Industrial Safety Hand Book “, 2nd Edn., McGraw-Hill Book Company, 1969.

2. Heinrich, H.W. Dan Peterson, P.E. and Rood, N., " Industrial Accident Prevention", McGraw-Hill Book Co., 1980.
3. Taylor, J.R., Risk analysis for process plant, pipelines and transport, Chapman and Hall, London, 1994

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the importance of safety and its objectives.	3	-	2	-	3	-	3	-	-	-	-	-	3	-	-	-
CO2	Understand the implementation of safety and identification and prevention of Accidents.	2	2	-	-	2	-	2	-	-	-	-	-	-	-	-	-
CO3	Know about the types of hazards, emergency plan and ISO standards for safety studies.	3	-	3	2	-	-	3	-	-	-	-	-	-	-	2	-
CO4	Do the safety audit in plants.	2	3	2	-	-	-	2	-	-	-	-	-	-	1	-	-
CO5	Do the risk analysis in industries using the various techniques.	3	3	-	-	3	-	3	-	-	-	-	-	3	-	-	-
Overall CO		3	3	2	2	3	-	3	-	-	-	-	-	3	1	2	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5028	MULTICOMPONENT DISTILLATION	L T P C 3 0 0 3

OBJECTIVE

The course is aimed to

- To learn about the principles of thermodynamics.
- To know the properties of thermodynamics for evaluation.
- To estimate the minimum reflux ratio for MCD system.
- To know various methods of MCD column design.
- To gain knowledge on various types of MCD column.

UNIT I THERMODYNAMIC PRINCIPLES 9

Fundamental Thermodynamic principles involved in the calculation of vapor – liquid equilibria and enthalpies of multi component mixtures – Use of multiple equation of state for the calculation of K values – Estimation of the fugacity coefficients for the vapor phase of polar gas mixtures – calculation of liquid – phase activity coefficients.

UNIT II THERMODYNAMIC PROPERTY EVALUATION 9

Fundamental principles involved in the separation of multi component mixtures – Determination of bubble-point and Dew Point Temperatures for multi component mixtures – equilibrium flash distillation calculations for multi component mixtures – separation of multi component mixtures at total reflux.

UNIT III MINIMUM REFLUX RATIO FOR MCD SYSTEM 9

General considerations in the design of columns – Column sequencing – Heuristics for column sequencing – Key components – Distributed components – Non-Distributed components – Adjacent keys. Definition of minimum reflux ratio – calculation of Rm for multi component distillation – Underwood method – Colburn method.

UNIT IV VARIOUS METHODS OF MCD COLUMN DESIGN 9

Theta method of convergence – Kb method and the constant composition method – Application of the Theta method to complex columns and to system of columns – Lewis Matheson method – Stage and reflux requirements – Short cut methods and Simplified graphical procedures.

UNIT V VARIOUS TYPES OF MCD COLUMNS 9

Design of sieve, bubble cap, valve trays and structured packing columns for multi component distillation – computation of plate efficiencies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the principles of thermodynamics involving calculation of multicomponent properties.

CO2: Determine the thermodynamic properties of multicomponent mixtures.

CO3: Estimate the minimum reflux ratio of MCD column.

CO4: Predict the design of MCD using various methods.

CO5: Select from the various types of MCD columns for particular process.

Attested

TEXT BOOKS

1. Holland, C.D., “Fundamentals of Multi Component Distillation”, McGraw Hill Book Company, I Edition, 1997
2. Van Winkle, “Distillation Operations”, McGraw Hill Publications, 1987.

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the principles of thermodynamics involving calculation of multicomponent properties.	3	-	-	2	3	-	-	-	-	-	-	-	3	-	-	-
CO2	Determine the thermodynamic properties of multicomponent mixtures.	2	3	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	Estimate the minimum reflux ratio of MCD column.	3	-	2	2	2	-	-	-	-	-	-	-	3	-	-	-
CO4	Predict the design of MCD using various methods.	2	-	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO5	Select from the various types of MCD columns for particular process.	3	2	-	3	-	-	-	-	-	-	-	-	3	-	-	-
Overall CO		3	3	2	2	3	-	-	-	-	-	-	-	3	-	-	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5029 SAFETY AND ENVIRONMENTAL HEALTH LT P C
3 0 0 3

OBJECTIVE

The course is aimed to

- To know the modern safety concepts
- To ensure that potential hazards are identified
- To learn the mitigation measures
- To do the investigation of accidents
- To learn the methods involved in safety education and training

UNIT I CONCEPTS 9

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety.

UNIT II TECHNIQUES 9

Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

UNIT III ACCIDENT INVESTIGATION AND REPORTING 9

Concept of an accident, reportable and non-reportable accidents, unsafe act and condition – principles of accident prevention, Supervisory role- Role of safety committee – Accident causation models - Cost of accident. Overall accident investigation process - Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports-Class exercise with case study.

UNIT IV SAFETY PERFORMANCE MONITORING 9

permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety “t” score, safety activity rate – problems.

UNIT V SAFETY EDUCATION AND TRAINING 9

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

TOTAL : 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Understand the importance of developing Environment, Health and Safety systems in work places.

CO2: Investigate accidents and provide the mitigation measures

CO3: Learn the procedures involved in safety training

CO4: Do the safety performance monitoring

CO5: Know about the various safety policies

REFERENCES

1. Accident Prevention Manual for Industrial Operations”, N.S.C.Chicago, (1993).
2.Heinrich H.W. “Industrial Accident Prevention” McGraw-Hill Company, New York, (1980).
3. Krishnan N.V. “Safety Management in Industry” Jaico Publishing House, Bombay, (1997).
4. John Ridley, “Safety at Work”, Butterworth & Co., London, (2013).
5. Blake R.B., “Industrial Safety” Prentice Hall, Inc., New Jersey, (1981).

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the importance of developing Environment, Health and Safety systems in work places.	3	-	-	3	-	3	3	3	-	-	-	-	3	-	1	-
CO2	Investigate accidents and provide the mitigation measures.	3	-	2	2	-	3	3	3	-	-	-	-	-	2	-	1
CO3	Learn the procedures involved in safety training.	3	-	3	2	2	-	2	3	-	-	-	-	-	-	-	-
CO4	Do the safety performance monitoring	3	-	2	-	2	-	3	3	-	-	1	-	-	-	-	-
CO5	Know about the various safety policies.	3	2	-	2	-	-	2	2	-	-	-	-	-	-	-	-
Overall CO		3	2	2	2	2	3	3	3	-	-	1	-	3	2	1	1

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AS5030 **PROCESS ENGINEERING** **L T P C**

OBJECTIVE: **3 0 0 3**

The course is aimed to

- To understand the basic concepts behind oil and gas facilities.
- To understand the fundamentals in process engineering.
- To know about the process design.
- To understand the flow diagrams used in industries.
- To know about the equipment used in process plants.

UNIT I INTRODUCTION TO OIL AND GAS FACILITIES **9**

Introduction to Oil and Gas Industry-Process description- Piping elements- Instruments: field instruments, control valves- Process equipments- Role of Process Engineer.

UNIT II INTRODUCTION TO PROJECT ENGINEERING **9**

Elements in Project Execution, Different Phases of a Project-(Basic Engineering package-BEP, Front End Engineering Design-FEED, Proposal Engineering, EPC-EPCM Contract, LSTK), Elements of Engineering, Process Engineering Deliverables.
Introduction to Piping design engineering, Instrument Design Engineering.

UNIT III PROCESS SIMULATION AND DESIGN **9**

Introduction and purpose- Software used for Simulation, Simulation inputs- Steady state simulation- Typical operation in simulation schemes- Heat and material balance generation, Dynamic Simulation Study and its uses. Introduction to Relief and Blow down Studies, Pipeline Flow assurance Study-Steady State and Transient, software used in Flow assurance Studies, Introduction to AIV/FIV studies, CFD analysis

UNIT IV ENGINEERING DIAGRAMS **9**

Block flow diagram-Process/Utility flow diagram-Symbols for P&ID development: piping elements, control system-Operation & control philosophy-Cause and Effect chart- typical PID development for Glycol Dehydration unit, Process Safety Flow diagrams, SAFE Chart. Introduction to Plot plan, General arrangement drawings.

UNIT V FACILITIES ENGINEERING **9**

Process Design Basis and Design Criteria, Overview of various process equipment and its design principles: Separators, Pumps, Compressors, Heat exchangers, Absorber column, Heaters, Air coolers, Storage Tanks, Line hydraulics (Gas, Liquid and Multiphase lines)- Pump Hydraulics- Control valve hydraulics, software used in Equipment design (Column, Heat Exchanger etc.). Introduction to various Codes and Standards followed in a PROJECT (API, TEMA, ISA etc.

COURSE OUTCOME: **TOTAL: 45 PERIODS**

On completion of the course students are expected to
CO1: Know about the basic concept of equipment in oil and gas industry.
CO2: Know about the project execution, different phases in a project.
CO3: Understand the software used for simulation and flow studies.
CO4: Understand the PFD, P&ID for various processes.
CO5: Understand the works in an EPC company.

REFERENCES

1. Perry's Chemical Engineers' Handbook, Robert H. Perry, October 2007.
2. GPSA Engineering Data Book, Gas Processors Suppliers Association, 13th Edition 2012.
3. American Petroleum Institute (API) Standards.
4. ISA Standards
5. TEMA standards, Tubular Exchanger Manufacturers Association, Inc.

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Know about the basic concept of equipment in oil and gas industry.	3	-	-	3	-	3	3	3	-	-	-	-	3	-	1	-
CO2	Know about the project execution, different phases in a project.	3	-	2	2	-	3	3	3	-	-	-	-	-	2	-	1
CO3	Understand the software used for simulation and flow studies.	3	-	3	2	2	-	2	3	-	-	-	-	-	-	-	-
CO4	Understand the PFD, P&ID for various processes.	3	-	2	-	2	-	3	3	-	-	1	-	-	-	-	-
CO5	Understand the works in an EPC company.	3	2	-	2	-	-	2	2	-	-	-	-	-	-	-	-
Overall CO		3	2	2	2	2	3	3	3	-	-	1	-	3	2	1	1

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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CH5071 **ENERGY TECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES

The course is aimed to

- To learn about classification of energy sources.
- To know about the conventional energy resources.
- To know about the non-conventional energy resources.
- To gain knowledge about biomass energy.
- To understand the energy conservation.

UNIT I ENERGY **9**

Introduction to energy – Global energy scene – Indian energy scene - Units of energy, conversion factors, general classification of energy, energy crisis, energy alternatives

UNIT II CONVENTIONAL ENERGY **9**

Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

UNIT III NON-CONVENTIONAL ENERGY **9**

Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrieus rotor and Gravian rotor, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV BIOMASS ENERGY **9**

Biomass origin - Resources – Biomass estimation. Thermochemical conversion – Biological conversion, Chemical conversion – Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, integrated gasification.

UNIT V ENERGY CONSERVATION **9**

Energy conservation - Act; Energy management importance, duties and responsibilities; Energy audit – Types methodology, reports, instruments. Benchmarking and energy performance, material and energy balance, thermal energy management.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.

CO2: Excel as professionals in the various fields of energy engineering

CO3: Compare different renewable energy technologies and choose the most appropriate based on local conditions.

CO4: Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies

CO5: Develop in-depth technical understanding of energy problems at an advanced level.

TEXTBOOKS

1. Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.
2. Rai, G.D., Non-conventional Energy Sources, Khanna Publishers, New Delhi, (2011).
3. Nagpal, G.R., Power Plant Engineering, Khanna Publishers, 2008.
4. Energy Management, Paul W.O'Callaghan McGraw – Hill, 1993

Attested

REFERENCES

1. Nejat Vezirog, Alternate Energy Sources, IT, McGraw Hill, New York (1981).
2. El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.
3. Sukhatme. S.P., Solar Enery - Thermal Collection and Storage, Tata McGraw hill, New Delhi, (2008).

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4. Handbook of Energy Audit by 7th edition Albert Thumann, P.E., C.E.M & William J Younger C.E.M, Faiment Press 2008

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.	3	-	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO2	Excel as professionals in the various fields of energy engineering	2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	Compare different renewable energy technologies and choose the most appropriate based on local conditions.	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies	2	3	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO5	Develop in-depth technical understanding of energy problems at an advanced level.	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Overall CO		3	3	3	2	3	-	-	-	-	-	-	-	-	-	-	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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GE5071 **DISASTER MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES:

The course is aimed to

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR) To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity
- To learn the applications and case studies in disaster management.

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

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COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand foundations of hazards, disasters and associated natural/social phenomena and to provide knowledge on response during different types of Disasters

CO2: Manage the Public Health aspects and Humanitarian Assistance of the disasters and Capacity to describe analyze various aspects influencing vulnerabilities and capacities.

CO3: Understand the Technological innovations and their usage during various phases of Disaster

CO4: To enhance awareness of institutional process, vulnerability profile, Policies, Law, and methods of assessment in the country

CO5: Gain the capacity to obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios.

TEXTBOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand foundations of hazards, disasters and associated natural/social phenomena and to provide knowledge on response during different types of Disasters	3	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	Manage the Public Health aspects and Humanitarian Assistance of the disasters and Capacity to describe analyze various aspects influencing vulnerabilities and capacities.	2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	Understand the Technological innovations and their usage during various phases of Disaster	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	To enhance awareness of institutional process, vulnerability profile, Policies, Law, and methods of assessment in the country	3	2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	Gain the capacity to obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios.	2	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Overall CO		3	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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CH5751	TRANSPORT PHENOMENA	L T P C
		3 0 0 3

OBJECTIVE

The course is aimed to

- To describe the heat, mass,momentum transfer in various parameters.
- To gain knowledge on energy transport.
- To learn about temperature distribution.
- To learn about concentration distribution.
- To determine velocity, temperature and concentration profiles.

UNIT I MOMENTUM TRANSPORT **9**

Viscosity, temperature effect on viscosity of gases and liquids, Newton's law, mechanism of momentum transport, shell balance method, pressure and velocity distributions in falling film, circular tube, annulus, slit.

UNIT II ENERGY TRANSPORT **9**

Thermal conductivity, temperature and pressure effect on thermal conductivity of gases and liquids, Fourier's law, mechanism of energy transport, shell energy balance, temperature distribution in solids and laminar flow, with electrical, nuclear, viscous, chemical heat source, heat conduction through composite walls, cylinders, spheres, fins, slits.

UNIT III TEMPERATURE DISTRIBUTION **9**

Energy equations, special forms, use of equations of change, dimensional analysis of equations of change, time-smoothed equations of change, empirical expressions, temperature distribution for turbulent flow in tubes, jets.

UNIT IV CONCENTRATION DISTRIBUTION **9**

Diffusivity, temperature and pressure effect, Fick's law, mechanism of mass transport, theory of diffusion in gases and liquids, shell mass balances, concentration distribution in solids and in laminar flow: stagnant gas film, heterogeneous and homogeneous chemical reaction systems, falling film, porous catalyst. The equation of continuity, summary of equations of change and fluxes, use of equations of change, dimensional analysis, time smoothed equations of change, empirical expressions for turbulent mass flux.

UNIT V ANALOGIES BETWEEN TRANSPORT PROCESSES **9**

Turbulence, Reynolds equation for incompressible turbulent flow, Reynolds stresses Prandtl's mixing length theory, Eddy viscosity, the statistical theory of turbulence, Correlation coefficients, intensity and scale of turbulence. Turbulence measurement, Hot – wire anemometer. Turbulence flow in a closed conduit, Prandtl's Power law of Velocity distribution in smooth and rough pipes. Analogy between Momentum, Heat and Mass transfer. The Reynolds' Analogy for turbulent flow over a flat plate, The Prandtl's Analogy, The Von karmon Analogy, Coulburn analogy

TOTAL : 45 PERIODS

COURSE OUTCOMES

On completion of the course students are expected to

CO1: Understand the mechanisms of momentum, heat and mass transfer each at molecular, micro and macro levels.

CO2: Develop mathematical models to determine transfer fluxes and velocity, temperature and concentration distribution for flow channels, heat sources and systems involving diffusion and reactions.

CO3: Determine the interrelationship between the molecular, microscopic and macroscopic descriptions of transport processes and compare the various coordinate systems to formulate equations of change.

CO4: Apply the equation of change for different coordinate systems and solve of momentum, mass and heat transport problems.

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CO5: Analyze the analogy between the transports and understand the turbulence and boundary layer concept in heat and mass transport.

TEXT BOOKS

1. Bird R.B., Stewart W.E. and Lightfoot E.N., Transport Phenomena, 2nd Edition, Wiley, New York, (2007).
2. Brodkey, R. S., and Hershey, H. C., " Transport Phenomena - A unified approach", McGraw-Hill, (2003).

REFERENCES

1. Welty, J. R., Wilson, R. W., and Wicks, C. W., "Fundamentals of Momentum Heat and Mass Transfer ", 5thedition John Wiley, New York, 2007.
2. Slattery, J. S., "Advanced Transport Phenomena", 2nd Edition, Cambridge University Press, London, 1999
3. Knudson J.G. and Katz D.L., "Fluid Dynamics and Heat Transfer ", 2nd Edition, McGraw Hill, New York, 2000

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the mechanisms of momentum, heat and mass transfer each at molecular, micro and macro levels.	3	-	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Develop mathematical models to determine transfer fluxes and velocity, temperature and concentration distribution for flow channels, heat sources and systems involving diffusion and reactions	3	-	2	2	-	2	-	-	-	-	-	-	-	-	-	-
CO3	Determine the interrelationship between the molecular, microscopic and macroscopic descriptions of transport processes and compare the various coordinate systems to formulate equations of change.	2	3	-	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	Apply the equation of change for different coordinate systems and solve of momentum, mass and heat transport problems.	-	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	Analyze the analogy between the transports and understand the turbulence and boundary layer concept in heat and mass transport.	2	-	2	-	3	-	-	-	-	-	-	-	-	-	-	-
Overall CO		3	3	2	2	3	2	-	-	-	-	-	-	-	-	-	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5031 SPECTROSCOPIC TECHNIQUES FOR PETROLEUM ENGINEERS L T P C
3 0 0 3

OBJECTIVES

The course is aimed to

- To understand the concept of spectroscopy and analysis method.
- To learn the concept of UV and Visible Spectroscopy.
- To learn the Quantitative spectroscopy.
- To understand the concept of IR spectroscopy.
- To understand the atomic spectroscopic studies.
-

UNIT I INTRODUCTION TO SPECTROSCOPIC METHODS OF ANALYSIS 9

Electromagnetic radiation - Various ranges, Dual properties, Various energy levels, Interaction of photons with matter, Classifications of Instrumental methods - absorbance & transmittance and their relationship - Permitted energy levels for the electrons of an atom and simple molecule - Jablonski diagrams - Various electronic transitions in organic and inorganic compounds effected by UV and Visible radiations - Various energy level diagrams of saturated, unsaturated and carbonyl compounds, excitation by UV and Visible radiations - Choice of solvents, cut off wavelengths for solvents - Effects of auxochromes and effects of conjugation on the absorption maxima, Different shifts of absorption peaks (Bathochromic, hypsochromic, hypochromic, hyperchromic),

UNIT II UV AND VISIBLE SPECTROSCOPY 9

Qualitative Spectroscopy- Lamda max and epsilon max rules, , Woodward -Fieser rules for the calculation of absorption maxima (Lamda max) for dienes and carbonyl compounds, Fieser and Kuhn rules - Instrumentation for UV and Visible spectrophotometer (source, optical parts and detectors)-Applications of UV and Visible spectroscopy.

UNIT III QUANTITATIVE SPECTROSCOPY 9

Beer-Lambert's law, Limitations, Deviations (Real, Chemical, Instrumental) problems based on Beer-Lamberts equation- Estimation of inorganic ions such as Fe^{2+}, Fe^{3+}, Ni^{2+} and estimation of Nitrite using Beer-Lambert's Law- Multicomponent analysis (no overlap, single way overlap and two way overlap) -Photometric titrations (Experimental set-up and various types of titrations and their corresponding curves).

UNIT IV IR SPECTROSCOPY 9

Theory of IR spectroscopy, various stretching and vibration modes for diatomic and triatomic molecules (both linear and nonlinear), various ranges of IR (Near, Mid, Finger print and Far) and their usefulness, Instrumentation (Only the sources and detectors used in different regions), sample preparation techniques. Qualitative analysis of alkanes, alkenes and carbonyl compounds.

UNIT V ATOMIC SPECTROSCOPY 9

Atomic absorption spectrophotometry: Principle, Instrumentation (Types of burners, Types of fuels, Hollow cathode lamp, Chopper only) and Applications, Various interferences observed in AAS (Chemical, radiation and excitation) Flame photometry: Principle, Instrumentation, quantitative analysis (Standard addition method and internal standard method) and applications, Differences between AAS and FES

TOTAL : 45 PERIODS

COURSE OUTCOME:

On completion of the course students are expected to

CO1: Understand the concept of spectroscopy and its types.
CO2: Know about UV and visible spectroscopy, Qualitative spectroscopy.
CO3: Understand Beer-lambert's, limitation and deviation.
CO4: Do the analysis using various spectroscopy methods
CO5: Understand the concept of Atomic spectroscopy, its principle and applications

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TEXT BOOK

1. B. Sivasankar, Instrumental methods of Analysis" Oxford University Press , 2012

REFERENCES

1. Douglas A. Skoog, F. James Holler, Stanley R. Crouch, Instrumental Analysis, CENGAGE Learning, India, 7th Edition, 2007.
2. Willard H.H, Merritt L.L, Dean J.A and Settle F.A, Instrumental method of analysis, 7thedition,Wadsworth Publishing Company, 1988.
3. Sharma, B.K., Instrumental Methods of Analysis, Goel publishing House, 24th Edition,2005.
4. William Kemp, Organic Spectroscopy, 3rd Edition, Palgrave publishers, 2007.
5. Gurdeep R. Chatwal, Sharma K. Anand, Instrumental methods of Chemical Analysis, Himalaya Publishers, New Delhi, 2014
6. John R Dyer, Applications of Absorption Spectroscopy of Organic Compounds, Prentice-hall of India Pvt. Ltd., 2012
7. Robert M.Silverstein, Francis X.Webstrer, David Kiemle, David L.Bryce, Spectrometric Identification of Organic Compounds, Wiley, 8th Edition

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the concept of spectroscopy and its types.	3	2	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Know about UV and visible spectroscopy, Qualitative spectroscopy.	3	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO3	Understand Beer-lambert's, limitation and deviation	2	2	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	Do the analysis using various spectroscopy methods.	3	2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	Understand the concept of Atomic spectroscopy, its principle and applications.	2	2	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Overall CO		3	2	3	2	3	-	-	-	-	-	-	-	-	-	-	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AS5032 INTRODUCTION TO POLYMER TECHNOLOGY LT P C
3 0 0 3

OBJECTIVE:

The course is aimed to

- To study about macromolecules and its theory.
- To know about various polymerization techniques.
- To learn the preparation of polymers using the techniques
- To determine the molecular weight of polymers
- To gain knowledge on transition in polymers.

UNIT I INTRODUCTION 9

History of Macromolecules – structure of natural products like cellulose, rubber,proteins – concepts of macro molecules – Staudinger's theory of macromolecules – difference between simple organic molecules and macromolecules.

UNIT II ADDITION POLYMERIZATION 9

Chemistry of Olefins and Dienes – double bonds – Chemistry of free radicals – monomers – functionality – Polymerization: Initiation – types of initiation – free radical polymerization – cationic polymerization – anionic polymerization – coordination polymerization – industrial polymerization – bulk, emulsion, suspension and solution polymerization techniques – Kinetics – Copolymerization concepts.

UNIT III CONDENSATION POLYMERIZATION 9

Simple condensation reactions – Extension of condensation reactions to polymer synthesis – functional group reactivity – polycondensation – kinetics of polycondensation- Carother's equation – Linear polymers by polycondensation – Interfacial polymerization – crosslinked polymers by condensation – gel point.

UNIT IV MOLECULAR WEIGHTS OF POLYMERS 9

Difference in molecular weights between simple molecules and polymers – number average and weight average molecular weights – Degree of polymerization and molecular weight – molecular weight distribution – Polydispersity – molecular weight determination. Different methods – Gel Permeation Chromatography – Osmometry, Light Scattering.

UNIT V TRANSITIONS IN POLYMERS 9

First and second order transitions – Glass transition, Tg – multiple transitions in polymers – experimental study – significance of transition temperatures – crystallinity in polymers – effect of crystallization – in polymers – factors affecting crystallization crystal nucleation and growth – relationship between Tg and Tm – Relationship between properties and crystalline structure.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to

CO1: Understand the fundamentals of polymers and mechanism of polymerization techniques.
CO2: Apply the mechanism and effectiveness of polymerization in making finished materials.
CO3: Understand the knowledge of polymer stability and unique definition of the product by evaluating molecular weight
CO4: Understand the manufacture and properties of application oriented industrial polymers.
CO5: Acquire knowledge on different tests for characterization of polymer for applications in R & D work

TEXTBOOKS:

1. Billmeyer.F.W.,Jr, Text Book of Polymer Science, Ed. Wiley-Interscience, 2007.
2. Seymour.R.B., and Carraher.C.E., Jr., Polymer Chemistry, 2nd Ed., Marcel Dekker, 2003.
3. Gowariker.V.T.,Viswanathan.N.V., and Sreedar.J., Polymer Science, Wiley Eastern Ltd., 2006.

REFERENCES:

1. Joel,R.F; Polymer Science and Technology, Eastern Economy Edition, 2014.

2. Rodriguez, F., Cohen.C., Oberic.K and Arches, L.A., Principles of Polymer Systems, 6th edition, Taylor an (2014).

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome															
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Understand the fundamentals of polymers and mechanism of polymerization techniques.	3	-	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Apply the mechanism and effectiveness of polymerization in making finished materials.	3	-	2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	Understand the knowledge of polymer stability and unique definition of the product by evaluating molecular weight	3	-	2	-	2	2	-	-	-	-	-	-	-	-	-	-
CO4	Understand the manufacture and properties of application oriented industrial polymers.	3	-	2	-	2	3	-	-	-	-	-	-	-	-	-	-
CO5	Acquire knowledge on different tests for characterization of polymer for applications in R & D work.	3	-	2	-	3	2	-	-	-	-	-	-	-	-	-	-
Overall CO		3	-	2	3	3	2	-	-	-	-	-	-	-	-	-	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

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AUDIT COURSES (AC)

AD5091 CONSTITUTION OF INDIA

L	T	P	C
3	0	0	0

OBJECTIVES:

- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I INTRODUCTION 9

History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES 9

Fundamental Rights-Right to Equality-Right to Freedom-Right against Exploitation Right to Freedom of Religion-Cultural and Educational Rights-Right to Constitutional Remedies Directive Principles of State Policy-Fundamental Duties

UNIT III ORGANS OF GOVERNANCE 9

Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions

UNIT IV EMERGENCY PROVISIONS 9

Emergency Provisions - National Emergency, President Rule, Financial Emergency

UNIT V LOCAL ADMINISTRATION 9

District's Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila Pachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level-Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Able to understand history and philosophy of Indian Constitution.
CO2: Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3: Able to understand powers and functions of Indian government.
CO4: Able to understand emergency rule.
CO5: Able to understand structure and functions of local administration.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									✓			✓
CO2									✓			✓
CO3									✓			✓
CO4									✓			✓
CO5									✓			✓

Attested

TEXTBOOKS:

1. Basu D D, Introduction to the Constitution of India, Lexis Nexis, 2015.
2. Busi S N, Ambedkar B R framing of Indian Constitution, 1st Edition, 2015.
3. Jain M P, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. The Constitution of India (Bare Act), Government Publication,1950

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AD5092 **VALUE EDUCATION** **L T P C**
3 0 0 0

OBJECTIVES:

- Develop knowledge of self-development
- Explain the importance of Human values
- Develop the overall personality through value education
- Overcome the self destructive habits with value education
- Interpret social empowerment with value education

UNIT I INTRODUCTION TO VALUE EDUCATION 9

Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation, Standards and principles, Value judgements

UNIT II IMPORTANCE OF VALUES 9

Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline

UNIT III INFLUENCE OF VALUE EDUCATION 9

Personality and Behaviour development - Soul and Scientific attitude. Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendshipHappiness Vs suffering, love for truth.

UNIT IV REINCARNATION THROUGH VALUE EDUCATION 9

Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature Character and Competence –Holy books vs Blind faith, Self-management and Good health, Science of reincarnation

UNIT V VALUE EDUCATION IN SOCIAL EMPOWERMENT 9

Equality, Non violence, Humility, Role of Women, All religions and same message,Mind your Mind, Self-control, Honesty, Studying effectively

TOTAL: 45 PERIODS

OUTCOMES:

CO1 – Gain knowledge of self-development
CO2 – Learn the importance of Human values
CO3 – Develop the overall personality through value education
CO4 – Overcome the self destructive habits with value education
CO5 – Interpret social empowerment with value education

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							✓	✓				✓
CO2							✓	✓	✓			✓
CO3							✓	✓	✓			✓
CO4							✓	✓				✓
CO5							✓	✓				✓

Attested

REFERENCES:

1. Chakroborty , S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press ,New Delhi

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AD5093 **PEDAGOGY STUDIES** **L T P C**
3 0 0 0

OBJECTIVES:

- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

UNIT I INTRODUCTION AND METHODOLOGY: 9

Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions **-** Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW 9

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES 9

Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT 9

Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS 9

Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 45 PERIODS

OUTCOMES:

- Understand the methodology of pedagogy.
- Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Know the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												✓
CO2												✓
CO3												✓
CO4												✓
CO5												✓

Attested

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REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

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AD5094 **STRESS MANAGEMENT BY YOGA**

L T P C
3 0 0 0

OBJECTIVES:

- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do's and Don't's in life through Yam
- Categorize Do's and Don't's in life through Niyam
- Develop a healthy mind and body through Yog Asans
- Invent breathing techniques through Pranayam

UNIT I INTRODUCTION TO YOGA **9**

Definitions of Eight parts of yog.(Ashtanga)

UNIT II YAM **9**

Do`s and Don't's in life.
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT III NIYAM **9**

Do`s and Don't's in life.
Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT IV ASAN **9**

Various yog poses and their benefits for mind & body

UNIT V PRANAYAM **9**

Regularization of breathing techniques and its effects-Types of pranayam

TOTAL: 45 PERIODS

OUTCOMES:

CO1 – Develop healthy mind in a healthy body thus improving social health also improve efficiency
CO2 – Learn Do's and Don't's in life through Yam
CO3 – Learn Do's and Don't's in life through Niyam
CO4 – Develop a healthy mind and body through Yog Asans
CO5 – Learn breathing techniques through Pranayam

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							✓	✓				✓
CO2							✓	✓				✓
CO3							✓	✓				✓
CO4							✓	✓				✓
CO5							✓	✓				✓

REFERENCES:

1. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
2. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur

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AD5095 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS L T P C
3 0 0 0

OBJECTIVES:

- Develop basic personality skills holistically
- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind, pleasing personality and determination
- Discover wisdom in students

UNIT I NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I 9

Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)

UNIT II NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II 9

Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)

UNIT III APPROACH TO DAY TO DAY WORK AND DUTIES 9

Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV STATEMENTS OF BASIC KNOWLEDGE – I 9

Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA 9

Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 45PERIODS

OUTCOMES:

CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									✓			✓
CO2									✓			✓
CO3									✓			✓
CO4									✓			✓
CO5									✓			✓

REFERENCES:

1. Gopinath,Rashtriya Sanskrit Sansthanam P, Bhartrihari's ThreeSatakam , Niti-sringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram,Publication Department, Kolkata,2016

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AD5097 ESSENCE OF INDIAN KNOWLEDGE TRADITION L T P C
3 0 0 0

COURSE OBJECTIVES

The course will introduce the students to

- get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I INTRODUCTION TO CULTURE 9

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II INDIAN LANGUAGES AND LITERATURE 9

Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III RELIGION AND PHILOSOPHY 9

Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)

UNIT IV FINE ARTS IN INDIA (ART, TECHNOLOGY& ENGINEERING) 9

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V EDUCATION SYSTEM IN INDIA 9

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 45PERIODS

COURSE OUTCOMES

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

- Understand philosophy of Indian culture.
- Distinguish the Indian languages and literature.
- Learn the philosophy of ancient, medieval and modern India.
- Acquire the information about the fine arts in India.
- Know the contribution of scientists of different eras.
- Understand education systems in India

REFERENCES:

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”,ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450 494-X, 200
4. Narain, “Examinations in ancient India”, Arya Book Depot, 1993
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
6. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN 13: 978-8120810990, 2014

AD5098 **SANGA TAMIL LITERATURE APPRECIATION** **L T P C**
3 0 0 0

Course Objectives: The main learning objective of this course is to make the students an appreciation for:

1. Introduction to Sanga Tamil Literature.
2. 'Agathinai' and'Purathinai' in SangaTamil Literature.
3. 'Attruppadai' in SangaTamil Literature.
4. 'Puranaanuru' in SangaTamil Literature.
5. 'Pathitrupaththu' in SangaTamil Literature.

UNIT I SANGA TAMIL LITERATUREANINTRODUCTION **9**

Introduction to Tamil Sangam–History of Tamil Three Sangams–Introduction to Tamil Sangam Literature–Special Branches in Tamil Sangam Literature- Tamil Sangam Literature's Grammar- Tamil Sangam Literature's parables.

UNIT II 'AGATHINAI'AND'PURATHINAI' **9**

Tholkappiyar's Meaningful Verses–Three literature materials–Agathinai's message- History of Culturefrom Agathinai– Purathinai–Classification–Mesaage to Society from Purathinai.

UNIT III 'ATTRUPPADAI'. **9**

AttruppadaiLiterature–Attruppadaiin'Puranaanuru'-Attruppadaiin'Pathitrupaththu'-Attruppadai in 'Paththupaattu'.

UNIT IV 'PURANAANURU' **9**

Puranaanuru onGood Administration,Rulerand Subjects–Emotion&itsEffectin Puranaanuru.

UNIT V 'PATHITRUPATHTHU' **9**

Pathitrupaththuin'Ettuthogai'–Pathitrupaththu'sParables–Tamildynasty:Valor,Administration, Charity in Pathitrupaththu- Mesaage to Society from Pathitrupaththu.

Total (L:45) = 45 PERIODS

COURSE OUTCOMES: Upon completionofthiscourse, the studentswillbeable to:

1. Appreciate and apply the messages in Sanga Tamil Literature in their life.
2. Differentiate'Agathinai' and'Purathinai'in their personal andsocietallife.
3. Appreciate and apply the messages in' Attruppadai' in their personal and societalife.
4. Appreciate and apply the messages in' Puranaanuru' in their personal and societallife.
5. Appreciate and apply the messages in' Pathitrupaththu' in their personal and societallife.

REFERENCES:

1. Sivaraja Pillai, The Chronology oftheEarlyTamils,SagwanPress,2018.
2. HankHeifetz andGeorgeL. Hart, The Puranануru,Penguin Books,2002.
3. Kamil Zvelebil, The Smile of Murugan: OnTamil Literature of South India, Brill Academic Pub,1997.
4. GeorgeL. Hart, Poetsof theTamil Anthologies: AncientPoemsofLove andWar, Princeton University Press,2015.
5. XavierS.Thani Nayagam, Landscape and poetry:a study of nature in classical Tamil poetry,Asia Pub.House, 1967.

CO	P												PS		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1									0.9						0.6
2									0.9						0.6
3									0.9						0.6
4									0.9						0.6
5									0.9						0.6

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HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

HU5171 **LANGUAGE AND COMMUNICATION** **L T P C**
3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

Objectives

- ✓ To familiarize students with the concept of communication using linguistic and non linguistic resources.
- ✓ To help students ask critical questions regarding facts and opinions.
- ✓ To provide students with the material to discuss issues such as language and power structures.
- ✓ To help students think critically about false propaganda and fake news.

Learning Outcomes

- ➢ Students will be able to use linguistic and non linguistic resources of language in an integrated manner for communication.
- ➢ Students will be able to analyse communication in terms of facts and opinions.
- ➢ Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION: 9

a) Writing and Speech
b) Distinction between language structure and language use, form and function, acceptability and grammaticality
c) Gestures and Body language, pictures and symbols, cultural appropriacy
d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II STRUCTURE OF WRITING/CONVERSATION: 9

a) Language skills and the communication cycle; speaking and listening, writing and reading
b) Initiating and closing conversations, intervention, turn taking
c) Writing for target reader, rhetorical devices and strategies
d) Coherence and Cohesion in speech and writing

UNIT III POWER STRUCTURE AND LANGUAGE USE: 9

a) Gender and language use
b) Politeness expressions and their use
c) Ethical dimensions of language use
d) Language rights as part of human rights

UNIT IV MEDIA COMMUNICATION: 9

a) Print media, electronic media, social media
b) Power of media
c) Manufacturing of opinion, fake news and hidden agendas

UNIT V PERSUASIVE COMMUNICATION AND MISCOMMUNICATION: 9

a) Fundamentals of persuasive communication
b) Persuasive strategies
c) Communication barriers

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Austin, 1962, J.L. How to do things with words. Oxford: Clarendon Press. Grice, P.1989. Studies in the way of words. Cambridge, M.A: Harvard University Press.
2. Chomsky, N.1966. Aspects of the theory of syntax, The MIT press, Cambridge. Chomsky, N.2006. Language and Mind, Cambridge University Press.
3. Hymes. D.N. 1972, On communication competence in J.B. Pride and J.Holmes (ed), Sociolinguistics, pp 269-293, London Penguin.
4. Gilbert, H.Harman, 1976. Psychological aspect of the theory of syntax in Journal of Philosophy, page 75-87.
5. Stephen. C. Levenson, 1983, Pragmatics, Cambridge University press.

6. Stangley, J. 2007. Language in Context. Clarendon press, Oxford. 7. Shannon, 1942. A Mathematical Theory of Communication. 8. Searle, J.R. 1969. Speech acts: An essay in the philosophy of language. Cambridge: Cambridge University Press.

HU5172 VALUES AND ETHICS L T P C
3 0 0 3

OBJECTIVES:

- Teach definition and classification of values.
- Explain Purusartha.
- Describe Sarvodaya idea.
- Summarize sustenance of life.
- Conclude views of hierarchy of values.

UNIT I DEFINITION AND CLASSIFICATION OF VALUES 9

Extrinsic values- Universal and Situational values- Physical- Environmental-Sensuous- Economic-Social-Aesthetic-Moral and Religious values

UNIT II CONCEPTS RELATED TO VALUES 9

Purusartha-Virtue- Right- duty- justice- Equality- Love and Good

UNIT III IDEOLOGY OF SARVODAYA 9

Egoism- Altruism and universalism- The Ideal of Sarvodaya and Vasudhaiva Kutumbakam

UNIT IV SUSTENANCE OF LIFE 9

The Problem of Sustenance of value in the process of Social, Political and Technological Changes

UNIT V VIEWS ON HIERARCHY OF VALUES 9

The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Able to understand definition and classification of values.
CO2: Able to understand purusartha.
CO3: Able to understand sarvodaya idea.
CO4: Able to understand sustenance of life.
CO5: Able to understand views of hierarchy of values.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								✓	✓			✓
CO2								✓	✓			✓
CO3								✓	✓			✓
CO4								✓	✓			✓
CO5								✓	✓			✓

TEXTBOOKS:

1. AwadeshPradhan :MahamanakeVichara. (B.H.U., Vanarasi-2007)
2. Little, William, : An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)
3. William, K Frankena : Ethics (Prentice Hall of India, 1988)

HU5173 **HUMAN RELATIONS AT WORK** **L T P C**
3 0 0 3

OBJECTIVES:

- Illustrate human relations at work its relationship with self.
- Explain the importance of interacting with people at work to develop teamwork.
- Infer the importance of physical health in maintaining human relations at work.
- Describe the importance of staying psychologically healthy.
- Identify the essential qualities for progressing in career.

UNIT I UNDERSTANDING AND MANAGING YOURSELF 9

Human Relations and You: Self-Esteem and Self-Confidence: Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II DEALING EFFECTIVELY WITH PEOPLE 9

Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

UNIT III STAYING PHYSICALLY HEALTHY 9

Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV STAYING PSYCHOLOGICALLY HEALTHY 9

Managing Stress and Personal Problems, Meditation.

UNIT V DEVELOPING CAREER THRUST 9

Getting Ahead in Your Career, Learning Strategies, Perception, Life Span Changes, and Developing Good Work Habits.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

CO1: Understand the importance of self-management.
CO2: Know how to deal with people to develop teamwork.
CO3: Know the importance of staying healthy.
CO4: Know how to manage stress and personal problems.
CO5: Develop the personal qualities essential for career growth.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓		✓	✓			✓
CO2									✓	✓		✓
CO3						✓		✓	✓			✓
CO4								✓				✓
CO5								✓	✓	✓		✓

TEXT BOOK:

1. Dubrien, A. J. (2017). Human Relations for Career and Personal Success: Concepts, Applications, and Skills, 11th Ed. Upper Saddle River, NJ: Pearson.

REFERENCES:

1. Greenberg, J. S. (2017). Comprehensive stress management (14th edition), New York: McGraw Hill.
2. Udai, Y. (2015). Yogasanaurpranayam. New Delhi: N.S. Publications.

HU5174 **PSYCHOLOGICAL PROCESSES** **L T P C**
3 0 0 3

COURSE DESCRIPTION

Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people's psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES

The major objectives of this course is

- To develop students' awareness – on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT 1: INTRODUCTION

What is psychology? - Why study psychology? - Psychology as science – Behavior and its role in human communication – socio-cultural bases of behaviour – Biological bases of behavior - Brain and its functions – Principles of Heredity – Cognition and its functions Fields of psychology – Cognitve and Perceptual – Industrial and Organizational.

UNIT 2: SENSORY & PERCEPTUAL PROCESSES

Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation -Sensory bombardment; ESP - Social Perception.

UNIT 3: COGNITION & AFFECT

Learning and memory – philosophy of mind – concepts - words – images – semantic features – Association of words – Repetition – Retrieval – Chunking - Schemata - Emotion and motivation – nature and types of motivation – Biological & Psychosocial motivation – nature and types of emotions – physiological & cognitive bases of emotions – expressions of emotions – managing negative emotions - enhancing positive emotions.

UNIT 4: THINKING, PROBLEM-SOLVING & DECISION MAKING

Thinking skills – Types of thinking skills – Concrete & Abstract thinking – Convergent & Divergent - Analytical & Creative thinking – Problem & Possibility thinking – Vertical & Lateral thinking – Problem solving skills – stages of problem solving skills – Decision making - intuition and reasoning skills - Thinking and language - The thinking process- concepts, problem solving, decision-making, creative thinking; language communication.

UNIT 5: PERSONALITY & INTELLIGENCE

Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.

References

1. Morgan, C.T.and King, R.A (1994) Introduction to Psychology, Tata McGraw Hill Co Ltd, New Delhi.
2. Robert A. Baron (2002), Psychology, 5th Edition, Prentice Hall, India.
3. Michael W.Passer, Ronald E.smith (2007), Psychology: The science of mind and Behavior,3rd Edition Tata McGraw-Hill Edition.
4. Robert S.Feldman (2004) Understanding Psychology 6th Edition Tata McGraw – Hill.
5. Endler, N. S., & Summerfeldt, L. J. (1995). Intelligence. personality. psychopathology. and adjustment. In D. H. Saklofske & M. Zeidner (Eds.). International handbook of personality and intelligence (pp. 249-284). New York: Plenum Press.
6. Ford, M. E. (1994). A living systems approach to the integration of personality and intelligence. In R. J. Sternberg. & P. Ruzgis (Eds.). Personality and intelligence (pp. 188-21 7). New York: Cambridge University Press.

De Bono, E (1990) Lateral Thinking, Harper Perennial, New York.

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HU5175 **EDUCATION, TECHNOLOGY AND SOCIETY** **L T P C**
3 0 0 3

COURSE DESCRIPTION

This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long lasting impact of good education in a technologically advanced society.

COURSE OBJECTIVES:

The course aims

- To help learners understand the basics of different types of technology utilised in the field of education
- To make them realize the impact of education in society
- To make them evolve as responsible citizen in a technologically advanced society

LEARNING OUTCOMES

By the end of the course, learners will be able to

- Understand the various apps of technology apps and use them to access, generate and present information effectively.
- Apply technology based resources and other media formats equitably, ethically and legally.
- Integrate their technical education for betterment of society as well as their personal life.

UNIT I INDIAN EDUCATION SYSTEM

Gurukul to ICT education – Teacher as facilitator – Macaulay's Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II LEARNING THEORIES

Learning Theories – Behaviorism – Cognitivism – Social Constuctivism – Humanism Learning Styles – Multiple Intelligences – Emotional Intelligence – Blooms Taxonomy

UNIT III TECHNOLOGICAL ADVANCEMENTS

Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV EDUCATIONAL TECHNOLOGY

Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V ETHICAL IMPLICATIONS

Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

TOTAL:45 PERIODS

TEACHING METHODS

Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.

EVALUATION

As this is course is not a content based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end semester examination. Internals marks can be taken for the total marks.

INTERNAL (100 % WEIGHTAGE)

(a) Written Test (40 marks)
(b) Assignment: Write a real time report of the technology use in any school / college (15 marks)
(c) Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)
(d) Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)
(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

Attested

REFERENCES

1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington

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HU5176 **PHILOSOPHY** **L T P C**
3 0 0 3

OBJECTIVES

- To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
- To Fosters critical thinking and imagination by dealing with inter-related concepts in literature and science.
- To bridge the gap between the sciences and humanities through introspective analyses.
- To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one's self and others.

UNIT I KNOWLEDGE **9**

Knowledge (Vidya) Versus Ignorance (Avidya)- Brihadaranyaka Upanishad. Unity and Multiplicity – Isha Upanishad. What is True Knowledge? Ways to True Knowledge. Introduction to Philosophy of Yoga, Socratic Debate, Plato's Views. Asking and Answering Questions to Stimulate Critical Thinking and to Draw Ideas. Argumentative Dialogues. Dialectical Methods to Arrive at Conclusions.

UNIT II ORIGIN **9**

Origin of Universe And Creation – 'Nasidiya Sukta' in Relation With Big Bang Theory. Greek Concept of Chaos. The Concept of Space – Space as the Final Goal – Udgitha. Relationship Between Teacher And Student – The Knowledge Of Combinations, Body And Speech – Siksha Valli – Taittriya Upanishad.

UNIT III WORD **9**

Aum- Speech and Breath as Pair – Chandogya Upanishad and Brihadaryanaka Upanishad. Significance of Chants, Structure of Language and Cosmic Correspondences. The Non-Dual Word – Bhartrihari's Vakyapadiyam. Sphota-Ultimate Reality Expressed Through Language. Intention. Thought 'Sabdanaor' and Speaking.

UNIT IV KNOWLEDGE AS POWER/OPPRESSION **9**

Power- as Self-Realization in Gita. Krishna's Advice to Arjuna on How to Conquer Mind. Francis Bacon – Four Idols – What Prevents One From Gaining Knowledge? Michel Foucault- Knowledge as Oppression. Panopticon. Rtam (Truth) and Satyam (Eternal Truth).

UNIT V SELF KNOWLEDGE/BRAHMAN **9**

Knowledge about Self, Transcendental Self. The Different Chakras and the Stages of Sublimation. Philosophy of Yoga and Siva for Union of Mind and Body. Concept of Yin/Yang. Aspects of the Feminine / Masculine.

TOTAL : 45 PERIODS

OUTCOMES:

On completion of the course, the students will be able to:

1. Think sceptically, ask questions and to arrive at deductions.
2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:

1. Swami Nikhilananda: The Upanishads, Swami Nikhilananda, Advaita Ashrama, Kolkata.
2. Swamy Tapasyananda: Srimad Bhagavad Gita, The Scripture of Mankind, Sri Ramakrishna Math, Chennai.
3. Subrahmanyam, Korada: Vakyapadiyam of Bhartrhari Brahmakanda, Sri Garib Dass series.
4. Swami Lokeswarananda: Chandogya Upanishad, Swami Lokeswarananda, Ramakrishna Mission Institute of Culture, Kolkata.
5. Brahma, Apuruseya: The Four Vedas: Translated in English.
6. Haich, Elizabeth: Sexual Energy and Yoga.
7. Bacon, Francis: Power as Knowledge
8. Vlastos, Gregory: Socrates Ironist and Moral Philosopher.
9. Plato: The Republic, Penguin.
10. Gutting, Garry: Foucault A Very Short Introduction, Oxford.

HU5177 APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE LT P C
3 0 0 3

UNITI INTRODUCTION 7
Natureandfields.

UNITII PSYCHOLOGYININDUSTRIESAND ORGANIZATIONS 9
Jobanalysis; fatigue and accidents; consumer behavior.

UNITIII PSYCHOLOGY AND MENTALHEALTH 11
Abnormality, symptoms and causes psychological disorders

UNITIV PSYCHOLOGY AND COUNSELING 7
Need of Counseling, Counsel or and the Counselee, Counseling Process, Areas of Counseling.

UNITV PSYCHOLOGY AND SOCIALBEHAVIOUR 11
Group, group dynamics, team building,Prejudice and stereotypes; Effective Communication, conflict and negotiation.

TOTAL:45 PERIODS

TEXTBOOKS

1. Schultz,D.&Schultz,S.E.(2009). PsychologyandWorkToday(10thed.). New Jersey:Pearson/PrenticeHall
2. Butcher,J.N., Mineka,S.,&Hooley,J. M.(2010). Abnormal psychology(14th ed.).NewYork: Pearson
3. Gladding,S.T. (2014).Counselling:Acomprehensiveprofession. NewDelhi: PearsonEducation
4. Aronson, E.,Wilson, T. D.,&Akert, R. M.(2010).Social Psychology(7th Ed.). UpperSaddleRiver,NJ: PrenticeHall

HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

HU5271	GENDER, CULTURE AND DEVELOPMENT	L T P C 3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to Gender Studies that asks critical questions about the meanings of sex and gender in Indian society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary drawing from Indian literature and media studies, to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with class, caste and other social identities. This course also seeks to build an understanding of the concepts of gender, gender-based violence, sexuality, and rights and their impact on development through a number of discussions, exercises and reflective activities.

Objectives

- ✓ To familiarize students with the concepts of sex and gender through literary and media texts.
- ✓ To help students ask critical questions regarding gender roles in society.
- ✓ To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
- ✓ To help students think critically about gender based problems and solutions.

Learning Outcomes

- ➢ Students will be able to critically read literary and media texts and understand the underlying gender perspectives in them.
- ➢ Students will be able to analyse current social events in the light of gender perspectives.
- ➢ Students will be able to discuss, analyse and argue about issues related to gender and their impact on society, culture and development.

UNIT I: Introduction to Gender

- Definition of Gender
- Basic Gender Concepts and Terminology
- Exploring Attitudes towards Gender
- Social Construction of Gender

Texts:

1. Sukhu and Dukhu (Amar Chitra Katha)
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir. London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.)

UNIT II: Gender Roles and Relations

- Types of Gender Roles
- Gender Roles and Relationships Matrix
- Gender-based Division and Valuation of Labour

Texts:

1. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011)
2. Video: Witness: Freeing Women From Cleaning Human Waste (2014, HRW, Manual Scavenging, India)

UNIT III: Gender Development Issues

- Identifying Gender Issues
- Gender Sensitive Language
- Gender, Governance and Sustainable Development
- Gender and Human Rights
- Gender and Mainstreaming

Texts:

1. The Many Faces of Gender Inequality (Essay, Amartya Sen, Frontline, Volume 18 - Issue 22, Oct. 27 - Nov. 09, 2001)
2. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta)

UNIT IV: Gender-based Violence

- The concept of violence
- Types of Gender-based violence
- The relationship between gender, development and violence

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- Gender-based violence from a human rights perspective

Texts:
1. Lights Out (Play, Manjula Padmanabhan)
2. Lights Out (Video of play enacted)

UNIT V: Gender and Culture

- Gender and Film
- Gender, Media and Advertisement

Texts:
1. Mahanagar (Movie: Satyajit Ray)
2. Beti Bachao Beti Padhao Advertisements

READINGS: Relevant additional texts for readings will be announced in the class. Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

ASSESSMENT AND GRADING:
Discussion & Classroom Participation: 20%
Project/Assignment: 30%
End Term Exam: 50%

HU5272 ETHICS AND HOLISTIC LIFE L T P C
3 0 0 3

OBJECTIVES:

- To emphasize the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.
- To understand the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society.

UNIT I HUMAN LIFE, ITS AIM AND SIGNIFICANCE

The concept of a successful life, happy life and a meaningful life, Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

UNIT II CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT

Intellectual, Emotional, Creative, Ethico - spiritual development, Aesthetic sense, Self-dependency, Activeness, Development of positive attitude.

UNIT III HARMONY IN PERSONAL AND SOCIAL LIFE:

Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all, Creating a value based work culture in hostel, classroom and other places in the campus and society.

UNIT IV CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE

Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance.

UNIT V DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE

Science, Technology, Consumerism, Relation with Nature and Environment, New dimension of Global Harmony: Democracy, Equality, Social Justice

TOTAL:45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:

1. Enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
2. Develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and

integrate them in their personality after cross examination.

3. Enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.
4. Develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5. Enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

HU5273 LAW AND ENGINEERING LT P C
3 0 0 3

UNIT I THE LEGAL SYSTEM: SOURCES OF LAW AND THE COURT STRUCTURE 9

Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court) Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

UNIT II LAWS 9

Basic principles of contract law, sale of goods law, laws relating to industrial pollution, accident, environmental protection, health and safety at work, patent law, constitutional law: the supreme law of the land, Information technology law and cyber crimes.

UNIT III BUSINESS ORGANISATIONS 9

Sole traders (Business has no separate identity from you, all business property belongs to you).

Partnerships: Types of Partnerships - Limited Liability Partnership, General Partnership, Limited Partnerships. Companies: The nature of companies, Classification of companies, Formation of companies, Features of a public company, Carrying on business, Directors– Their Powers and Responsibilities/Liabilities.

UNIT IV LAW AND SOCIETY 9

Interdisciplinary nature of law, legal ideologies/philosophy/ schools of jurisprudence.

UNIT V CASE STUDIES 9

Important legal disputes and judicial litigations

TOTAL: 45 PERIODS

HU5274 FILM APPRECIATION LT P C
3 0 0 3

COURSE DESCRIPTION

This is an intensive course designed to promote comprehensive understanding and insights into the nature of cinema and other related forms and practices. Movies, though at times are used more as escapism, they are also a true art form and expressive tool used by writers, directors and actors. This course will explore the aesthetics of cinema, the concepts behind storytelling and various other elements of a film. It will also explore the impact of movies in our society and in our lives. It also encourages students to use films as a medium to analyse visual texts and read underlying messages.

OBJECTIVES:

- To help learners understand the various movie genres and its types.
- To understand various elements that contributes to film making.
- To make them realize the impact of film in society.
- To analyse the visual media and interpret the underlying messages.

UNIT I THE COMPONENTS OF FILMS 9

Story, Screenplay & Script – Actors – Director – Crew Members – Mis En Scene – Structure of A Film – Narrative Elements – Linear & Non-Linear – Types of Movie Genres: Mysteries, Romantic Comedies, Horror Etc.

UNIT II EVOLUTION OF FILM **9**

History of Films – Early Cinema – Silent Movies – Talkies – Film Language, Form, Movement – Film Theories – Realist, Auteurists, Feminist, Psychonalyic, Idealogical Theories.

UNIT III FILMS ACROSS THE WORLD **9**

European Films – Russian Films – Japanese Films – Korean Films – Hollywood Film – Studio Culture – All Time Great Movies.

UNIT IV INDIAN FILMS **9**

The Early Era – History Of Indian Cinema – Movies for Social Change – Hindi Movies that Created Impact – Regional Movies – Documentaries – Cultural Identity.

UNIT V INTERPRETING FILMS **9**

Film Criticism & Appreciation – Censorship in Movies – Cultural Representation in Movies – Television – New Media & Online Media – Films Beyond Entertainment.

TOTAL: 45 PERIODS

OUTCOMES

On completion of the course, the students will be able to:

- Recognize types of films, their impact on society and their roles in our lives.
- Have an understanding of the concepts of storytelling, Mise en Scene, and other elements of film making.
- Interpret the underlying messages in the movies.

Teaching Methods

- Each unit consists of reading materials, learning activities videos, websites. Students are expected to watch movies sometimes in class and at times at home and discuss in class.

Evaluation

- As this is course is critical appreciation course on films, there is no written end semester examination. The course is more on learning how to critically analyse a movie and appreciate its finer elements. Therefore evaluation can be based on assignments and discussions. Internals marks can be taken for the total marks.

Internal (100 % weightage)

- Assignment 1: Write a movie review with critical analysis (20 marks).
- Assignment2 : Write a script for a scene taken from a short story / novella (20 marks).
- Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)
- Group discussion : Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
- Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES

1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983
5. The Encyclopedia of Indian Cinema Edited by Ashish Rajadhyaksha and Paul Willemen, BFI, 1994.

HU5275 FUNDAMENTALS OF LANGUAGE AND LINGUISTICS **L T P C**
3 0 0 3

OBJECTIVES

- To broadly introduce students to the formal and theoretical aspects of linguistics.
- To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.

Attested

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CONTENTS : -

UNIT I LANGUAGE AND LINGUISTICS: AN OVERVIEW 9

Language and Linguistics-Linguistic Knowledge-Knowledge of Sound Systems & Words – Creativity of Language – Relationship of form and meaning. Grammar – descriptive, prescriptive, universal-Human Language – Animal Language – Sign Language- Computers and Language.

UNIT II MORPHOLOGY - WORDS OF LANGUAGE 9

Content and function words – morphemes -free & bound –prefixes – suffixes – roots and stems –inflectional and derivational morphology-compound words and their formation – malapropisms – slips of the tongue.

UNIT III SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS-THE MEANING OF LANGUAGE 9

Syntax : Rules of Syntax- Sentence Structure-Structural Ambiguity-Syntactic Categories. Semantics: Lexical Semantics – Anomaly-Metaphors- Idioms- Synonyms – Antonyms – Homonyms -Pragmatics– Speech Acts

UNIT IV PHONETICS – THE SOUNDS OF LANGUAGE 9

Speech sounds- Introduction to branches of Phonetics- The Phonetic Alphabet – IPA – Consonants - Vowels – Diphthongs- Tone and Intonation.

UNIT V APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE 9

Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

TOTAL : 45 PERIODS

Teaching Methods :
Lectures, discussion.

Evaluation Internal and External :
Internal: 2 written tests + assignments, seminars, project (50+15+15+20).
External: A 3 hour written exam (50 marks)

REFERENCES :

1.Victoria Fromkin, Robert Rodman, Nina Hyams.2019.An Introduction to Language.USA.CENGAGE.11th edition
2. Cook. G,2003. Applied linguistics.UK: Oxford University Press.

HU5276 UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE L T P C
3 0 0 3

OBJECTIVES

- To internalize the importance of language by understanding its role in the transformation of man.
- To look at language, literature and culture as locus of identity and change.
- To extract meaning from existing literatures and cultures.
- To identify meanings in modern life by reconnecting with lost cultures.

Unit 1 Introduction

Why study literature? Tracing the origin – pictures. Tokens as precursors of writing. Movement from three dimensions to two dimensions- Pictography. From visual to oral -Logography. Reading out literature to young children- Edmund J Farrell.

Unit 2. Reading Culture

Reading culture through language, signs and consumables- Roland Barthes. Culture through poems- Nissim Ezekiel's ' The night of the Scorpion' . 'Nothing's Changed'- Tatamkhulu Afrika- Apartheid. Ruskin Bond- 'Night train at Deoli'- How real life is different from movies.

Unit 3. Identifying Meaning
Searching and locating meaning through literature. Looking for order in a chaotic world. The Myth of Sisyphus (Albert Camus) and Adi Shankar's 'Jagat Mithya'- the world as an illusion. The Indian version as 'meaninglesss meaning'.

Unit 4. Post Modernism
'If on a winter's night a traveler'- Italo Calvino. The book about the reader- the experience of reading as reading. Metafiction. Selfie Culture. Visual Culture as purpose of modern life.

Unit 5. Returning to Pictures
Literature of the present- Emphasis on the visual world. Twitterature. SMS. Whatsapp language. Consumer culture. Change in fixed gender notions. Interactive sessions. Introspection.

Reading list
1. Bond, Ruskin: 'Night train at Deoli'
2. Ezekiel, Nissim: ' The Night of the Scorpion'
3. Afrika,Tatamkhulu: 'Nothing's Changed'
4. Barthes, Roland: *Mythologies*
5. Shankaracharya: *Viveka Chudamani*
6. Camus, Albert- *The Myth of Sisyphus*
7. Calvino, Italo: *If on a winter's night a traveler*
8. Farrell, Edmund J: 'Listen, my children, and you shall read'

Outcome
- Can identify the connections among language, literature and culture.
- Is able to relate between seemingly different aspects of life.
- Understands the fractions in modern life and can assimilate meanings.