ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
REGULATIONS 2017
B. TECH. PETROLEUM ENGINEERING
CHOICE BASED CREDIT SYSTEM

1. Programme Educational Objectives (PEOs)

Graduates of B. Tech. Petroleum Engineering will

I. Exhibit a professional and ethical attitude, effective communication skills, teamwork , multidisciplinary approach, and an ability to solve the problems encountered in petroleum sector.
II. Gain knowledge in basic sciences, mathematics, reservoir engineering and onshore & offshore petroleum engineering.
III. Have a knowledge and competency in Petrochemical Engineering complemented by the appropriate skills and attributes.
IV. Understand the theory and applications of analytical equipment used in industries for testing the quality of petroleum and its products.
V. Address to meet the world's ever-increasing demand for hydrocarbon fuel, and waste management.

2. Programme Outcomes (POs)

On successful completion of the programme,

I. Graduates will be able to demonstrate their knowledge professionally and shoulder ethical responsibilities.
II. Graduates will able be to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
III. Graduates will be able to identify, formulate, and solve engineering problems related to petroleum industry.
IV. Graduates will be capable to design experiments, analyze and interpret data.
V. Graduates will be able to meet the world's ever-increasing demand for hydrocarbon fuel, reservoir engineering and waste management.
VI. Graduates will be able to communicate effectively and work in interdisciplinary groups.
VII. Graduates will have knowledge to analyze petroleum products.
VIII. Graduates will understand the characteristics of source and reservoir engineering.
IX. Graduates will become familiar with environmentally sound exploration, evaluation and recovery of oil, gas and other fluids in the earth.
X. Graduates will Understand the pre requisites of onshore & offshore reservoir engineering.

3. PEOs / POs Mapping

Programme Educational Objectives	Programme Outcomes									
	I	II	III	IV	V	VI	VII	VIII	IX	X
I	✓	✓	✓			✓				✓
II			✓	✓			✓			
III	✓		✓	✓	✓		✓	✓	✓	✓
IV		✓	✓				✓			
V		✓					✓	✓	✓	

4. Semester Course wise PEOs mapping

YEAR	SEM	Course Title	I	II	III	IV	V	VI	VII	VIII	IX	X
YEAR I	SEM I	Communicative English		√							√	
		Engineering Mathematics I		√				√				√
		Engineering Physics				√						
		Engineering Chemistry				√	√					
		Problem Solving and Python Programming	√	√								√
		Engineering Graphics	√									
		Physics and Chemistry Laboratory				√	√					
		Problem Solving and Python Programming Laboratory	√	√								√
	SEM II	Technical English		√							√	
		Engineering Mathematics II		√				√				√
		Physics of Materials				√						
		Organic Chemistry				√	√					
		Basic Mechanical Engineering			√							
		Introduction to Petroleum Engineering			√				√	√		
		Organic Chemistry Laboratory			√	√		√				
		Engineering Practices Laboratory			√							
YEAR II	SEM III	Probability and Statistics		√				√				√
		Reservoir Rocks and Fluid Properties			√				√	√		
		Engineering Mechanics			√							
		Fluids and Solid Operations			√	√		√				
		Process Calculations			√	√		√				
		Principles of Electrical and Electronics Engineering			√	√						√
		Electrical Engineering Laboratory			√	√						√
		Mechanical Engineering Laboratory			√	√		√				
	SEM IV	Chemical Engineering Thermodynamics			√	√		√				
		Geophysics	√		√	√	√					
		Chemistry for Technologists				√	√					
		Fundamentals of Petroleum Geology	√		√		√					

		Health, Safety and Environmental Management in Petroleum Industries	√	√	√			√				
		Heat Transfer			√	√		√				
		Fluids and Solid operations Laboratory			√							
		Chemical Analysis Laboratory				√	√					
YEAR III	SEM V	Process Control and Instrumentation	√	√	√						√	
		Mass Transfer			√	√		√				
		Reservoir Engineering I			√				√	√		
		Professional Communication	√								√	
		Heat Transfer Laboratory			√	√		√				
		Geology Laboratory	√		√	√	√					
	SEM VI	Well Drilling Equipment and Operation			√				√	√		
		Well Logging			√				√	√		
		Reservoir Engineering II			√				√	√		
		Professional Ethics in Engineering	√		√		√					
		Drilling Fluids and Cementing Techniques			√				√	√	√	
		Mass Transfer Laboratory			√	√		√				
		Petroleum Testing Laboratory			√				√	√		
YEAR IV	SEM VII	Petroleum Production Engineering			√				√	√		
		Environmental Science and Engineering	√		√		√					
		Drilling Fluids and Cementing Techniques Laboratory			√	√		√	√	√		
		Internship	√								√	
	SEMVIII	Project	√	√						√		
		Seminar	√	√						√		

ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
REGULATIONS 2017
B.TECH. PETROLEUM ENGINEERING
CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTERS (FULL TIME) CURRICULA AND SYLLABI

SEMESTER I

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	MA8151	Engineering Mathematics–I	BS	4	4	0	0	4
3.	PH8151	Engineering Physics	BS	3	3	0	0	3
4.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE8152	Engineering Graphics	ES	6	2	0	4	4
PRACTICALS								
7.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
			TOTAL	**31**	**19**	**0**	**12**	**25**

SEMESTER II

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS8251	Technical English	HS	4	4	0	0	4
2.	MA8251	Engineering Mathematics–II	BS	4	4	0	0	4
3.	PH8254	Physics of Materials	BS	3	3	0	0	3
4.	CY8291	Organic Chemistry	BS	3	3	0	0	3
5.	BE8256	Basic Mechanical Engineering	ES	4	4	0	0	4
6.	PE8201	Introduction to Petroleum Engineering	PC	3	3	0	0	3
PRACTICALS								
7.	CY8281	Organic Chemistry Laboratory	BS	4	0	0	4	2
8.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
			TOTAL	**29**	**21**	**0**	**8**	**25**

SEMESTER III

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA8391	Probability and Statistics	BS	4	4	0	0	4
2.	PE8301	Reservoir Rocks and Fluid Properties	PC	3	3	0	0	3
3.	GE8292	Engineering Mechanics	ES	5	3	2	0	4
4.	PE8302	Fluids and Solid Operations	PC	5	3	2	0	4
5.	CH8351	Process Calculations	PC	5	3	2	0	4
6.	EE8352	Principles of Electrical and Electronics Engineering	ES	3	3	0	0	3
PRACTICALS								
7.	EE8361	Electrical Engineering Laboratory	ES	4	0	0	4	2
8.	ME8362	Mechanical Engineering Laboratory	ES	4	0	0	4	2
			TOTAL	**33**	**19**	**6**	**8**	**26**

SEMESTER IV

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	PE8491	Chemical Engineering Thermodynamics	PC	3	3	0	0	3
2.	PE8401	Geophysics	PC	3	3	0	0	3
3.	CY8292	Chemistry for Technologists	BS	3	3	0	0	3
4.	PE8402	Fundamentals of Petroleum Geology	PC	4	4	0	0	4
5.	PE8403	Health, Safety and Environmental Management in Petroleum Industries	PC	3	3	0	0	3
6.	CH8591	Heat Transfer	PC	5	3	2	0	4
PRACTICALS								
7.	PE8461	Fluids and Solid Operations Laboratory	ES	4	0	0	4	2
8.	CH8281	Chemical Analysis Laboratory	BS	4	0	0	4	2
			TOTAL	**29**	**19**	**2**	**8**	**24**

SEMESTER V

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	PE8501	Process Control and Instrumentation	PC	5	3	2	0	4
2.	PE8502	Mass Transfer	PC	5	3	2	0	4
3.	PE8503	Reservoir Engineering I	PC	4	4	0	0	4
4.	HS8581	Professional Communication	EEC	2	0	0	2	1
5.		Professional Elective I	PE	3	3	0	0	3
6.		Open Elective I*	OE	3	3	0	0	3
PRACTICALS								
7.	CH8561	Heat Transfer Laboratory	PC	4	0	0	4	2
8.	PE8511	Geology Laboratory	PC	4	0	0	4	2
			TOTAL	**30**	**16**	**4**	**10**	**23**

* - Course from the curriculum of the other UG Programmes

SEMESTER VI

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	PE8601	Well Drilling Equipment and Operation	PC	3	3	0	0	3
2.	PE8602	Well Logging	PC	4	4	0	0	4
3.	PE8603	Reservoir Engineering II	PC	4	4	0	0	4
4.	GE8076	Professional Ethics in Engineering	HS	3	3	0	0	3
5.	PE8604	Drilling Fluids and Cementing Techniques	PC	3	3	0	0	3
6.		Professional Elective II	PE	3	3	0	0	3
PRACTICALS								
7.	CH8781	Mass Transfer Laboratory	PC	4	0	0	4	2
8.	PE8661	Petroleum Testing Laboratory	PC	4	0	0	4	2
			TOTAL	**28**	**20**	**0**	**8**	**24**

SEMESTER VII

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	PE8701	Petroleum Production Engineering	PC	3	3	0	0	3
2.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
3.		Professional Elective III	PE	3	3	0	0	3
4.		Professional Elective IV	PE	3	3	0	0	3
5.		Professional Elective V	PE	3	3	0	0	3
6.		Open Elective II*	OE	3	3	0	0	3
PRACTICALS								
7.	PE8711	Drilling Fluids and Cementing Techniques Laboratory	PC	4	0	0	4	2
8.	PE8712	Internship	EEC	0	0	0	0	2
			TOTAL	**22**	**18**	**0**	**4**	**22**

* - Course from the curriculum of the other UG Programmes

SEMESTER VIII

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.		Professional Elective VI	PE	3	3	0	0	3
PRACTICALS								
2.	PE8811	Project Work	EEC	20	0	0	20	10
3.	PE8812	Seminar	EEC	4	0	0	4	2
			TOTAL	**27**	**3**	**0**	**24**	**15**

TOTAL CREDITS : 184

PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE I, SEMESTER V

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	PE8091	Chemical Reaction Engineering	PE	3	3	0	0	3
2.	CH8075	Petroleum Refining and Petrochemicals	PE	3	3	0	0	3
3.	PE8092	Natural Gas Engineering	PE	3	3	0	0	3
4.	PE8001	Principles of Geochemistry	PE	3	3	0	0	3
5.	GE8071	Disaster Management	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE II, SEMESTER VI

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	PE8071	Advanced Separation Techniques	PE	3	3	0	0	3
2.	PE8002	Well Completion Testing and Work Over	PE	3	3	0	0	3
3.	PE8072	Catalytic Reaction Engineering	PE	3	3	0	0	3
4.	PE8003	Numerical Reservoir Simulation	PE	3	3	0	0	3
5.	GE8075	Intellectual Property Rights	PE	3	3	0	0	3

PROFESSIONAL ELECTIVEIII, SEMESTER VII

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	PE8004	Onshore and Offshore Engineering and Technology	PE	3	3	0	0	3
2.	PE8005	Petroleum Equipment Design	PE	3	3	0	0	3
3.	PE8073	Enhanced Oil Recovery	PE	3	3	0	0	3
4.	GE8074	Human Rights	PE	3	3	0	0	3

PROFESSIONAL ELECTIVEIV, SEMESTER VII

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	PE8006	Water Flooding and Enhanced Oil Recovery	PE	3	3	0	0	3
2.	PE8093	Plant Safety and Risk Analysis	PE	3	3	0	0	3
3.	PE8074	Multicomponent Distillation	PE	3	3	0	0	3
4.	CH8076	Piping and Instrumentation	PE	3	3	0	0	3
5.	GE8077	Total Quality Management	PE	3	3	0	0	3
6.	PE8007	Petroleum Transportation and Design	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE V, SEMESTER VII

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	PE8075	Petroleum Corrosion Technology	PE	3	3	0	0	3
2.	PE8008	Well Completion and Simulation	PE	3	3	0	0	3
3.	PE8079	Storage Transportation of Crude Oil and Natural Gas	PE	3	3	0	0	3
4.	PE8078	Reservoir Characterization and Modeling	PE	3	3	0	0	3

PROFESSIONAL ELECTIVEVI, SEMESTER VIII

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	PE8009	Oil Field Equipment Design and Drawing	PE	3	3	0	0	3
2.	PE8077	Process Economics	PE	3	3	0	0	3
3.	PE8076	Petroleum Economics	PE	3	3	0	0	3
4.	PE8010	Integrated Oil/Gas Field Evaluation	PE	3	3	0	0	3
5.	GE8073	Fundamentals of Nano Science	PE	3	3	0	0	3

SUBJECT AREAWISE DETAILS

HUMANITIES AND SOCIAL SCIENCES (HS)

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	HS8251	Technical English	HS	4	4	0	0	4
3.	GE8076	Professional Ethics in Engineering	HS	3	3	0	0	3
4.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3

BASIC SCIENCES (BS)

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	MA8151	Engineering Mathematics I	BS	4	4	0	0	4
2.	PH8151	Engineering Physics	BS	3	3	0	0	3
3.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
4.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
5.	MA8251	Engineering Mathematics II	BS	4	4	0	0	4
6.	PH8254	Physics of Materials	BS	3	3	0	0	3
7.	CY8291	Organic Chemistry	BS	3	3	0	0	3
8.	CY8281	Organic Chemistry Laboratory	BS	2	0	0	4	2
9.	MA8391	Probability and Statistics	BS	4	4	0	0	4
10.	CY8292	Chemistry for Technologists	BS	3	3	0	0	3
11.	CH8281	Chemical Analysis Laboratory	BS	4	0	0	4	2

ENGINEERING SCIENCES (ES)

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
2.	GE8152	Engineering Graphics	ES	4	2	0	4	4
3.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
4.	BE8256	Basic Mechanical Engineering	ES	4	4	0	0	4
5.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
6.	GE8292	Engineering Mechanics	ES	5	3	2	0	4
7.	EE8352	Principles of Electrical and Electronics Engineering	ES	3	3	0	0	3
8.	EE8361	Electrical Engineering Laboratory	ES	4	0	0	4	2
9.	ME8362	Mechanical Engineering Laboratory	ES	4	0	0	4	2
10.	PE8461	Fluid and Solid operations Laboratory	ES	4	0	0	4	2

PROFESSIONAL CORE (PC)

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	PE8201	Introduction to Petroleum Engineering	PC	3	3	0	0	3
2.	PE8301	Reservoir Rocks and Fluid Properties	PC	3	3	0	0	3
3.	PE8302	Fluids and Solid Operations	PC	5	3	2	0	4
4.	CH8351	Process Calculations	PC	5	3	2	0	4
5.	PE8491	Chemical Engineering Thermodynamics	PC	3	3	0	0	3
6.	PE8401	Geophysics	PC	3	3	0	0	3
7.	PE8402	Fundamentals of Petroleum Geology	PC	4	4	0	0	4
8.	PE8403	Health, Safety and Environmental Management in Petroleum Industries	PC	3	3	0	0	3
9.	CH8591	Heat Transfer	PC	5	3	2	0	4
10.	PE8501	Process Control and Instrumentation	PC	5	3	2	0	4
11.	PE8502	Mass Transfer	PC	5	3	2	0	4
12.	PE8503	Reservoir Engineering I	PC	4	4	0	0	4
13.	CH8561	Heat Transfer Laboratory	PC	4	0	0	4	2
14.	PE8511	Geology Laboratory	PC	4	0	0	4	2
15.	PE8601	Well Drilling Equipment and Operation	PC	3	3	0	0	3
16.	PE8602	Well Logging	PC	4	4	0	0	4

17.	PE8603	Reservoir Engineering II	PC	4	4	0	0	4
18.	CH8781	Mass Transfer Laboratory	PC	4	0	0	4	2
19.	PE8661	Petroleum Testing Laboratory	PC	4	0	0	4	2
20.	PE8604	Drilling Fluids and Cementing Techniques	PC	3	3	0	0	3
21.	PE8701	Petroleum Production Engineering	PC	3	3	0	0	3
22.	PE8711	Drilling Fluids and Cementing Techniques Laboratory	PC	4	0	0	4	2

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	HS8581	Professional Communication	EEC	2	0	0	2	1
2.	PE8712	Internship	EEC	0	0	0	0	2
3.	PE8811	Project Work	EEC	20	0	0	20	10
4.	PE8812	Seminar	EEC	4	0	0	4	2

SUMMARY

S. No.	SUBJECT AREA	CREDITS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1.	HUMANITIES AND SOCIAL SCIENCES (HS)	4	4	0	0	0	3	3	0	**14**
2.	BASIC SCIENCE (BS)	12	12	4	5	0	0	0	0	**33**
3.	ENGINEERING SCIENCE (ES)	9	6	11	2	0	0	0	0	**28**
4.	PROFESSIONAL COURE (PC)	0	3	11	17	16	18	5	0	**70**
5.	EMPLOYABILITY ENHANCEMENT COURSES(EEC)	0	0	0	0	1	0	2	12	**15**
6.	PROFESSIONAL ELECTIVES (PE)	0	0	0	0	3	3	9	3	**18**
7.	OPEN ELECTIVES (OE)	0	0	0	0	3	0	3	0	**6**
	TOTAL	**25**	**25**	**26**	**24**	**23**	**24**	**22**	**15**	**184**

HS8151	COMMUNICATIVE ENGLISH	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12

Reading- short comprehension passages, practice in skimming-scanning and predicting- **Writing**- completing sentences- - developing hints. **Listening**- short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development**- Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development-**- prefixes- suffixes- articles.- count/ uncount nouns.

UNIT II GENERAL READING AND FREE WRITING 12

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening**- telephonic conversations. **Speaking –** sharing information of a personal kind—greeting – taking leave- **Language development** – prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12

Reading- short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking**- asking about routine actions and expressing opinions. **Language development**- degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development –** single word substitutes- adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT 12

Reading- comprehension-reading longer texts- reading different types of texts- magazines **Writing**- letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening**- listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development**- synonyms-antonyms-phrasal verbs

UNIT V EXTENDED WRITING 12

Reading- longer texts- close reading –**Writing**- brainstorming -writing short essays **–** developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks-conversations- **Speaking –** participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations-fixed and semi-fixed expressions

TOTAL: 60 PERIODS

OUTCOMES: At the end of the course, learners will be able to:

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

1. Board of Editors. **Using English** A Coursebook for Undergarduate Engineers and Technologists**.** Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. **Interchange Students' Book-2** New Delhi: CUP, 2015.

REFERENCES

1 Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.

2 Comfort, Jeremy, et al. **Speaking Effectively : Developing Speaking Skillsfor BusinessEnglish.** Cambridge University Press, Cambridge: Reprint 2011

3 Dutt P. Kiranmai and RajeevanGeeta. **Basic Communication Skills,** Foundation Books: 2013

4 Means,L. Thomas and Elaine Langlois. **English & Communication For Colleges.** CengageLearning ,USA: 2007

5 Redston, Chris &Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005

MA8151 ENGINEERING MATHEMATICS – I L T P C
4 0 0 4

OBJECTIVES :

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS 12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

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

UNIT III 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 IV 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.

UNIT V DIFFERENTIAL EQUATIONS 12

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

TOTAL : 60 PERIODS

OUTCOMES :

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES :

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.

3. Narayanan, S. and Manicavachagom Pillai, T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.

PH8151 ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT II WAVES AND FIBER OPTICS 9

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers : population of energy levels, Einstein’s A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

UNIT III THERMAL PHYSICS 9

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Forbe’s and Lee’s disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck’s theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger’s wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course,

- The students will gain knowledge on the basics of properties of matter and its applications,
- The students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- The students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- The students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- The students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007.

CY8151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I WATER AND ITS TREATMENT 9

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption

isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.
Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

UNIT III ALLOYS AND PHASE RULE 9

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

UNIT IV FUELS AND COMBUSTION 9

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H_2-O_2 fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, “A Textbook of Engineering Chemistry”, S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, “Engineering Chemistry” Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

1. Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, “Engineering Chemistry”, Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, 2015.

GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVES:

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

UNIT I ALGORITHMIC PROBLEM SOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

OUTCOMES:

Upon completion of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.

GE8152 ENGINEERING GRAPHICS L T P C
2 0 4 4

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

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.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – 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- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal 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 traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12

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

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12

Sectioning of above 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.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+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 - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

TOTAL: 90 PERIODS

OUTCOMES:

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

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

REFERENCES:

1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy And Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.

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:

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. The students will be permitted to use appropriate scale to fit solution within A3 size. The examination will be conducted in appropriate sessions on the same day

GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C 0 0 4 2

OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

OUTCOMES:

Upon completion of the course, students will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL :60 PERIODS

BS8161	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
	(Common to all branches of B.E. / B.Tech Programmes)	0	0	4	2

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

OUTCOMES:

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

- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometery.

1. Estimation of HCl using Na_2CO_3 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 polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TOTAL: 30 PERIODS

TEXTBOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8^{TH} edition, 2014)

HS8251	TECHNICAL ENGLISH	L	T	P	C
		4	0	0	4

OBJECTIVES: The Course prepares second semester engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations , participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newsapapers- **Writing**- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development**- technical vocabulary **Language Development** –subject verb agreement - compound words.

UNIT II READING AND STUDY SKILLS 12

Listening- Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing**- interpreting cgarts, graphs- **Vocabulary Development-** vocabularyused in formal letters/emails and reports **Language Development-** impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR 12

Listening- Listening to classroom lectures/ talkls on engineering/technology -**Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing**-Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

UNIT IV REPORT WRITING 12

Listening- Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing**- email etiquette- job application – cover letter –Résumé preparation(via email and hard copy)- analytical essays and issue based essays--**Vocabulary Development**- finding suitable synonyms-paraphrasing-. **Language Development-** clauses- if conditionals.

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12

Listening- TED/Ink talks; **Speaking** –participating in a group discussion -**Reading**– reading and understanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey-**Vocabulary Development- verbal analogies Language Development-** reported speech

TOTAL : 60 PERIODS

OUTCOMES: At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication**. Cambridge University Press: New Delhi, 2016.

REFERENCES

1. Booth-L. Diana**, Project Work,** Oxford University Press**,** Oxford: 2014.
2. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. **Engineering English**. Orient Blackswan: Hyderabad,2015
4. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007
5. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.

MA8251 ENGINEERING MATHEMATICS – II L T P C
4 0 0 4

OBJECTIVES :

- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

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 VECTOR CALCULUS 12

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved

surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS 12

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c, cz, \frac{1}{z}, z^2$ - Bilinear transformation.

UNIT IV 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.

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 second order ordinary differential equations with constant coefficients.

TOTAL: 60 PERIODS

OUTCOMES :

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

REFERENCES :

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3rd Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

PH8254	PHYSICS OF MATERIALS (Common to courses offered in Faculty of Technology except Fashion Technology)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the physics of various materials relevant to different branches of technology

UNIT I PREPARATION OF MATERIALS 9

Phases - phase rule – binary systems – tie line rule – lever rule – phase diagram – invariant reactions - nucleation – homogeneous and heterogeneous nucleation – free energy of formation of a critical nucleus – Thin films – preparation: PVD, CVD method – Nanomaterials Preparation: wet chemical, solvothermal, sol-gel method.

UNIT II CONDUCTING MATERIALS 9

Classical free electron theory - expression for electrical conductivity – thermal conductivity, - Wiedemann-Franz law – electrons in metals: particle in a three-dimensional box- degenerate states – Fermi-Dirac statistics – density of energy states – electron in periodic potential (concept only) – electron effective mass – concept of hole. Superconducting phenomena, properties of superconductors – Meissner effect and isotope effect. Type I and Type II superconductors, High T_c superconductors – Magnetic levitation and SQUIDS.

UNIT III SEMICONDUCTING MATERIALS 9

Elemental Semiconductors - Compound semiconductors - Origin of band gap in solids (qualitative) - carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – variation of Fermi level with temperature – electrical conductivity – band gap determination – carrier concentration in n-type and p-type semiconductors (derivation) – variation of Fermi level with temperature and impurity concentration – Hall effect – determination of Hall coefficient – LED - Solar cells.

UNIT IV DIELECTRIC AND MAGNETIC MATERIALS 9

Dielectric, Paraelectric and ferroelectric materials - Electronic, Ionic, Orientational and space charge polarization – Internal field and deduction of Clausius Mosotti equation – dielectric loss – different types of dielectric breakdown – classification of insulating materials and their applications - Ferroelectric materials - Introduction to magnetic materials - Domain theory of ferromagnetism, Hysteresis, Soft and Hard magnetic materials – Anti-ferromagnetic materials – Ferrites, magnetoresistance materials.

UNIT V NEW MATERIALS AND APPLICATIONS 9

Metallic glasses – Shape memory alloys: Copper, Nickel and Titanium based alloys – graphene and its properties - Ceramics: types and applications – Composites: classification, role of matrix and reinforcement – processing of fibre reinforced plastics and fibre reinforced metals – Biomaterials: hydroxyapatite – PMMA – Silicone - Sensors: Chemical Sensors - Bio-sensors – conducting, semiconducting and photoresponsive polymers.

TOTAL : 45 PERIODS

OUTCOMES:

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

- gain knowledge on phase diagrams and various material processing methods,
- acquire knowledge on basics of conducting materials, superconductors and their applications

- get knowledge on the functioning of semiconducting materials and their applications in LED and solar cells,
- understand the functioning of various dielectric and magnetic materials ,
- have the necessary understanding on various advanced materials.

TEXT BOOKS:

1. Balasubramaniam, R. "Callister's Materials Science and Engineering". Wiley India Pvt. Ltd. 2014.
2. Kasap, S.O. "Principles of Electronic Materials and Devices". McGraw-Hill Education, 2007.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.

REFERENCES

1. Askeland, D. "Materials Science and Engineering". Brooks/Cole, 2010
2. Raghavan, V. "Materials Science and Engineering : A First course". PHI Learning, 2015.
3. Smith, W.F., Hashemi, J. & Prakash. R. "Materials Science and Engineering". Tata Mcgraw Hill Education Pvt. Ltd., 2014.

CY8291 ORGANIC CHEMISTRY L T P C
3 0 0 3

OBJECTIVE:

- To enable the students to learn the type of components in which organic reactions take place and also to know the preparation of the essential organic compounds.

UNIT I ORGANIC REACTION MECHANISM 9

Electrophilic reactions-Friedel crafts reaction, Riemer Tiemenn reaction, Beckmann rearrangements; nucleophilic reactions- aldol condensation, perkin reaction, benzoin condensation; free radical reaction-halogenation of alkane, addition of HBr on alkene in presence of peroxide; allylic halogenation - using N-Bromo Succinamide (NBS), thermal halogenation of alkene $CH_3 – CH = CH_2$.

UNIT II CARBOHYDRATES 9

Introduction – mono and disaccharides – important reactions – polysaccarides – starch and cellulose – derivatives of cellulose – carboxy methyl cellulose and gun cotton – structural aspects of cellulose

UNIT III POLYNUCLEAR AROMATICS AND HETEROCYCLES 9

Classification of polynuclear aromatics. naphthalene preparation, properties and uses. Classification of heterocyclic compounds. Furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline - preparation, properties and uses.

UNIT IV AMINO ACIDS AND PROTEINS 9

Classification, preparation (Strecker, Skraup, Gabriel phthalimide) and properties of Amino acids. Composition and classification of proteins. Structure of proteins – tests for proteins – general properties and relations of proteins – hydrolysis of proteins.

UNIT V DRUGS & DYES 9

Classification and properties of drugs. Penicillin sulpha drugs, mode of action, synthesis of sulphanilamide, chloroquine and chloroamphenicol.

Colour and constitution, chromogen and chromophore. Classification of dyes based on structure and mode of dyeing. Synthesis of dyes. Malachite green, methyl orange, congo red, phenolphthalein.

TOTAL: 45 PERIODS

OUTCOMES:

- At the end of the course students will have knowledge on various reaction mechanism, preparation of organic compounds and their properties.

TEXTBOOKS:

1. B.S.Bhal and Arun Bhal, "A Text Book of Organic Chemistry", 17th Ed., S Chand & Co. New Delhi, 2005.
2. R.T. Morrison and R.N. Boyd "Organic Chemistry", 7th Ed., Prentice Hall Inc. USA, 2010.

REFERENCES:

1. Jonathan Clayden, Nick Greeves, Staurt Warren and Peter Wothers, "Organic Chemistry", Oxford University Press, 2nd Ed., New Delhi, 2013.
2. K.S. Tiwari, N.K. Vishnoi, S.N. Mehrotra, "A Text Book of Organic Chemistry", Vikas Publishing House, 2nd Ed., New Delhi, 2006.

BE8256 BASIC MECHANICAL ENGINEERING L T P C

4 0 0 4

OBJECTIVE

- To impart knowledge on thermodynamics and thermal engineering power generating units such as engines and theory of machines

UNIT I LAWS OF THERMODYNAMICS 12

Basic concepts and hints; Zeroth law; First Law of Thermodynamics - Statement and application; Steady flow energy equation-problems- Second law of Thermodynamics – Kelvin - Plank statement and Clausius statement- problems; Limitations; Heat Engine, Refrigerator and Heat Pump, Available energy, Third law of Thermodynamics - Statement.

UNIT II HEATING AND EXPANSION OF GASES 12

Expressions for work done, Internal energy and heat transfer for Constant Pressure, Constant Volume, Isothermal, Adiabatic and Polytropic processes-Derivations and problems; Free expansion and Throttling process.

UNIT III AIR STANDARD CYCLES 12

Carnot cycle; Stirlings cycle; Joule cycle; Otto cycle; Diesel cycle; Dual combustion Cycle-Derivations and problems.

UNIT IV I.C. ENGINES, STEAM AND ITS PROPERTIES AND TEAM 12

Engine nomenclature and classification; SI Engine; CI Engine; Four Stroke cycle, Two stroke cycle; Performance of I.C.Engine; Brake thermal efficiency; Indicated Thermal Efficiency, Specific fuel consumption.

Steam - Properties of steam; Dryness fraction; latent heat; Total heat of wet steam; Dry steam; Superheated steam. Use of steam tables; volume of wet steam, volume of superheated steam;

External work of evaporation; Internal energy; Entropy of vapour, Expansion of vapour, Rankine cycle. Steam turbines – Impulse and Reaction types - Principles of operation.

UNIT V SIMPLE MECHANISM, FLY WHEEL, DRIVES AND BALNCING 12

Definition of Kinematic Links, Pairs and Kinematic Chains; Flywheel-Turning moment Diagram; Fluctuation of Energy. Belt and rope drives; Velocity ratio; slip; Creep; Ratio of tensions; Length of belt; Power Transmitted; gear trains-types. Balancing of rotating masses in same plane; Balancing of masses rotating in different planes.

TOTAL : 60 PERIODS

OUTCOME

- Students should learn thermodynamics and thermal engineering to understand the principles behind the operation of thermal equipments like IC engines and turbines etc., Students should be able to appreciate the theory behind operation of machinery and be able to design simple mechanisms

TEXT BOOKS

1. Nag, P.K., “Engineering Thermodynamics “, IInd Edition, Tata McGraw Hill Publishing Co., Ltd., 1995
2. Rajput, R .K, “Thermal Engineering”, Laxmi publications (P) Ltd, 2001.
3. Khurmi R.S., and Gupta J.K, “Theory of Machines”, Eurasia Publishing House (P) Ltd., 2004.

REFERENCES

1. Bhaskaran, K.A., and Venkatesh, A., “Engineering Thermodynamics “,Tata McGraw Hill, 1973.
2. Khurmi R.S., and Gupta J.K, “Thermal Engineering”, S.Chand & Company (P) Ltd.,2001.
3. Kothandaraman and Dhomkundwar,”: A course in Thermal Engineering (SI Units)”, Dhanpat Rai and Sons, Delhi (2001)
4. Pandya A. and Shah, “ Theory of Machines “, Charatakar Publishers, 1975.
5. Smith, “Chemical Thermodynamics “, Reinhold Publishing Co., 1977.

PE8201 INTRODUCTION TO PETROLEUM ENGINEERING L T P C

3 0 0 3

OBJECTIVE

- To provide an overview of petroleum industry. Petroleum exploration and exploitation techniques, oil and gas reserve identification and evaluation. Drilling and production of oil and gas. Desposal of effluents.

UNIT I 9

Earth science - occurrence of petroleum Rocks and traps. Reservoir rocks and properties. Classification of oil and gas reserves Reservoir mechanics and drive mechanism.

UNIT II 9

Drilling – introduction to drilling of oil and gas wells. Drilling rigs and equipments. Drilling fluids and cementing.

UNIT III **9**

Logging techniques. Various types of logs. Formation parameters. Log applications. Formation evaluation. Well completion.

UNIT IV **9**

Petroleum exploitation – well testing, production potential and well performances. Material balance, Artificial lift, Improved recovery methods.

UNIT V **9**

Surface equipments, processing of oil and gas. Transportation of oil and gas. Effluent treatment. Petroleum economics. Supply and demand trends.

TOTAL : 45 PERIODS

TEXT BOOKS / REFERENCE:

1. Geology of Petroleum by Leverson A.L.- 2nd edition The AAPG foundation, 2006.
2. Principles of oil production by T.E.W Nind- 2nd edition Mc Graw-Hill, 1981.
3. Introduction to Petroleum Engineering by Geltin
4. Wellsite Geological Techniques for petroleum exploration, Oxford and IBH publishing company, 1988

CY8281 **ORGANIC CHEMISTRY LABORATORY** **L T P C**
0 0 4 2

OBJECTIVE:

- To learn basic principles involved in analysis and synthesis of different organic derivatives.

LIST OF EXPERIMENTS

1. Quantitative analysis of organic compounds – Identification of aliphatic/aromatic, saturated/unsaturated compounds.
2. Identification and characterization of various functional groups by their characteristic reactions:
   a) alcohol, b) aldehyde, c) ketone, d) carboxylic acid, e) phenol, f) ester,
   g) primary, secondary and tertiary amines and h) nitro compounds.
3. Analysis of an unknown organic compound and preparation of suitable solid derivatives (Benzoic acid from Benzaldhehyde, hydrolysis of ester and meta- dinitrobenzene from nitrobenzene) .
4. Analysis of carbohydrates.
5. Analysis of proteins.
6. Methodology of filtration and recrystallization.
7. Introduction to organic synthetic procedures:
   i. Acetylation – Preparation of acetanilide from aniline.
   ii. Hydrolysis – Preparation of salycilic acid from methyl salyciliate.
   iii. Substitution – Conversion of acetone to iodoform.
   iv. Nitration – Preparation of m-dinitrobenzene from nitrobenzene.
   v. Oxidation – Preparation of benzoic acid from benzaldehyde/ benzyl alcohol

TOTAL: 60 PERIODS

List of Equipment for a Batch of 30 students

S. No.	Description of Equipment	Quantity
Essential		
1.	Bunsen burners	30
2.	LPG Cylinder in each row of the Laboratory	
3.	Hot Air Oven	2 Nos
4.	Hot Plate	6 Nos
5.	Water Bath	6 Nos
6.	Deep freezer	1 No.
7.	Magnetic Stirrers	6 Nos.
8.	Mechanical Stirrers	6 Nos.
9.	Refluxion Set up	
10.	Sharp Knives to cut sodium	6 Nos.
11.	Balance	
Desirable		
	Melting Point apparatus	

OUTCOME:

- The student is able to identify what distinguishes a strong and weak nucleophile and recall the rules of reactions. The student shows their mastery of nomenclature since ethyl bromide is not drawn out. The student analyzes a list of compounds and determines their reactivity.

REFERENCES:

1. Organic Chemistry Lab Manual, Chemistry Division, Chemical Engineering Department, A.C. Tech, Anna University, 2007.
2. Vogels's Text Book of Practical Organic Chemistry, Fifth Edition, Longman Singapore Publishers Pte. Ltd., Singapore, 1989.

GE8261 ENGINEERING PRACTICES LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.

(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 18

Welding:

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.

(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE 16

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.

3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:

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

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.
2. Carpentry vice (fitted to work bench)	15 Nos.
3. Standard woodworking tools	15 Sets.
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools: (a) Rotary Hammer	2 Nos
(b) Demolition Hammer	2 Nos
(c) Circular Saw	2 Nos
(d) Planer	2 Nos
(e) Hand Drilling Machine	2 Nos
(f) Jigsaw	2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each

4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

ELECTRONICS

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

MA8391 PROBABILITY AND STATISTICS L T P C
4 0 0 4

OBJECTIVE:

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 12

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL 12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS:

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

REFERENCES:

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

PE8301 RESERVOIR ROCKS AND FLUID PROPERTIES L T P C
3 0 0 3

OBJECTIVES:

To enable the students to understand

- Petroleum reservoir system and fluid properties
- Basic principles and operations in upstream petroleum industry

UNIT I **9**

The earth, crust, plate tectonics and geologic times. Sedimentary geology, Basins and Margins. Origin, accumulation and migration of petroleum. Properties of subsurface fluids. Petroleum Chemistry.

UNIT II **9**

Porosity. Permeability. Porosity – Permeability relationship. Electrical properties of rocks. Measurement of formation resistivity. Correlation of $F_R$with porosity, permeability and water saturation. F_R of ShalyReservoir rocks. Effect of stress on porous rocks. Formation evaluation.

UNIT III **9**

Fluid Satuaration and Capacity pressure. Determination of capillary pressure. Pore size distribution. Wettability. Evaluation of wettability and its effect on oil recovery. Alteration of

wettability. Effect of wettability on electrical properties of rocks.

UNIT IV **9**

Linear flow of incompressible fluids. Linear flow of gas. Darcy's and Poiseuille's laws. Various flow systems. Multiple permeability rocks.

UNIT V **9**

Reservoir fluid properties – Phase behaviour of hydrocarbon system. Fluid rock interactions. Reservoir fluid characteristics. PVT analysis. Flash liberation and differential liberation study**.**

TOTAL: 45 PERIODS

OUTCOME:

- Student will learn the use of Darcy's Law to calculate permeability of single phase; definition of interfacial tension; use of capillary pressure to determine saturation changes in reservoir; definition of effective and relative permeability; use of drainage/imbibition curves to characterize reservoir relative permeability.

TEXT BOOKS:

1. Craft, B.C. and Hawkins M.F. revised by Ronald E. Terry and J. Brandon Rogers, "Applied Petroleum Reservoir Engineering" third edition, Prentice-Hall (2014)
2. Djebbar Tiab and Erle C. Donaldson "Theory and practice of measuring Reservoir rock and fluid Transport properties" fourth edition, Gulf Professional Publishing (2015)

REFERENCE:

1. Amyx, J.W., Bass D.M. & Whiting., R.L., "Petroleum Reservoir Engineering" McGraw Hill 1998.

GE8292 **ENGINEERING MECHANICS** **L T P C**
3 2 0 4

OBJECTIVE:

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I STATICS OF PARTICLES **9+6**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces - additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II EQUILIBRIUM OF RIGID BODIES **9+6**

Free body diagram – Types of supports –Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS **9+6**

Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard

formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 9+6

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND RIGID BODY DYNAMICS 9+6

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL: 45+30=75 PERIODS

OUTCOMES:

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

- illustrate the vectorial and scalar representation of forces and moments
- analyse the rigid body in equilibrium
- evaluate the properties of surfaces and solids
- calculate dynamic forces exerted in rigid body
- determine the friction and the effects by the laws of friction

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

REFERENCES:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., "Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
5. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

PE8302 FLUIDS AND SOLID OPERATIONS L T P C

3 2 0 4

OBJECTIVE:

- To impart to the student knowledge on fluid properties, fluid static and dynamic characteristics flow metering and transport, particle mechanics, techniques of solid – fluid separation

UNIT I PROPERTIES OF FLUID 15

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 15

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 15

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

UNIT IV FLOW THROUGH FLUIDIZED BEDS 15

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

UNIT V CLASSIFIERS 15

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

TOTAL:75 PERIODS

OUTCOME:

- At the end of this course, the students will be able to understand the principles of fluid mechanics and applications of mechanical operations in process industries.

TEXT BOOKS:

1. Noel de Nevers, "Fluid Mechanics for Chemical Engineers ", Third Edition, McGraw-Hill, (2005).
2. Badger W.L. and Banchero J.T., "Introduction to Chemical Engineering", Fifth Edition, Tata McGraw Hill, 2001.

REFERENCES:

1. Munson, B. R., Young, D.F., Okiishi, T.H. "Fundamentals of Fluid Mechanics", 5th Edition", John Wiley, 2006
2. McCabe W.L, Smith, J C and Harriot. P "Unit operations in Chemical Engineering", McGraw Hill, V Edition, 2001
3. Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. I, 4th Edn., Asian Books Pvt. Ltd., India, 1998.

CH8351 PROCESS CALCULATIONS L T P C
3 2 0 4

OBJECTIVE:

- To acquire knowledge on laws of chemistry and its application to solution of mass and energy balance equations for single and network of units and introduce to process simulators.

UNIT I **15**

Base and derived Units - Composition of Mixture and solutions - calculations of pressure, volume and temperature using ideal gas law. Use of partial pressure and pure component volume in gas calculations, applications of real gas relationship in gas calculation.

UNIT II **15**

Stoichiometric principles, Application of material balance to unit operations like distillation, evaporation, crystallisation, drying etc., - Material balance with chemical reaction - Limiting and excess reactants - recycle - bypass and purging - Unsteady state material balances.

UNIT III **15**

Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity - Use of humidity in condensation and drying - Humidity chart, dew point.

UNITIV **15**

Heat capacity of solids, liquids, gases and solutions, use of mean heat capacity in heat calculations, problems involving sensible heat and latent heats, evaluation of enthalpy.Standard heat of reaction, heats of formation, combustion, solution, mixing etc., calculation of standard heat of reaction - Effect of pressure and temperature on heat of reaction -Energy balance for systems with and without chemical reaction - Unsteady state energy balances

UNIT V **15**

Determination of Composition by Orsat analysis of products of combustion of solid, liquid and gas fuels - Calculation of excess air from orsat technique, problems on sulphur and sulphur burning compounds - Application of Process simulators in energy and material balance problems.

TOTAL: 75 PERIODS

OUTCOMES:

- Understand the fundamentals of units and stoichiometric equations.
- Write material balance for different chemical process.
- Understand the fundamentals of ideal gas behavior and phase equilbria. Write energy balance for different chemical process.

TEXT BOOKS:

1. Bhatt, B.L., Vora, S.M., “Stoichiometry “, 4th Edition, Tata McGraw-Hill (2004)
2. Himmelblau, D.M., “Basic Principles and Calculations in Chemical Engineering”, EEE Sixth Edition, Prentice Hall Inc., 2003
3. Felder, R. M. and Rousseau, R. W., “Elementary Principles of Chemical Processes”,3rdEdn., John Wiley & Sons, New York, 2000.

REFERENCE:

1. Hougen O A, Watson K M and Ragatz R A, “Chemical process principles” Part I, CBS publishers (1973).

EE8352 PRINCIPLES OF ELECTRICAL AND ELECTRONICS ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

To impart knowledge on

- Electric circuit laws , single and three phase circuits and wiring
- Working principles of Electrical Machines
- Various electronic devices and measuring instruments

UNIT I ELECTRICAL CIRCUITS 9

Basic principles involved in power generation, transmission and distribution, Ohms Law ,Kirchoff's Law , steady state solution of DC circuits , Thevinin's Theorem, Norton's Theorem, Superposition Theorem.

UNIT II AC CIRCUITS 9

Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits, housing wiring, industrial wiring, materials of wiring.

UNIT III ELECTRICAL MACHINES 9

Principles of operation and characteristics of DC machines. Transformers (single and three phase) ,Synchronous machines , three phase and single phase induction motors.

UNIT IV ELECTRONIC DEVICES AND CIRCUITS 9

Types of Materials –Silicon & Germanium- N type and P type materials – PN Junction –Forward and Reverse Bias –Semiconductor Diodes –Bipolar Junction Transistor – Characteristics – transistor as an Amplifier –Introduction to operational Amplifier –Inverting Amplifier –Non Inverting Amplifier –DAC – ADC .

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Introduction to transducers: pressure, temperature, position, electrical measurements ,Classification of instruments – moving coil and moving iron Ammeter and Voltmeter – multimeters – dynamometer type Wattmeter – three-phase power measurements – energy meter – megger – instrument transformers (CT and PT)

TOTAL: 45 PERIODS

OUTCOMES:

Ability to

- Understand electric circuits and working principles of electrical machines
- Understand the concepts of various electronic devices
- Choose appropriate instruments for electrical measurement for a specific application

REFERENCES:

1. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
2. John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2006
3. Allan S Moris, "Measurement and Instrumentation Principles", Elseveir, First Indian Edition, 2006
4. Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall of India, 2006
5. Thereja .B.L., "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., 2008
6. V.K Mehta and Rohit Mehta, "Principle of Electrical Engineering", S. Chand & Company, 2008

EE8361 ELECTRICAL ENGINEERING LABORATORY L T P C

0 0 4 2

OBJECTIVE:

- To validate the principles studied in theory by performing experiments in the laboratory

LIST OF EXPERIMENTS

1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt and DC Series generator

3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on single phase transformer
5. O.C & S.C Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.
7. V curves and inverted V curves of synchronous Motor
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Study of DC & AC Starters

TOTAL: 60 PERIODS

OUTCOME:

- Ability to perform speed characteristic of different electrical machine

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	NAME OF THE EQUIPMENT	Qty. (Nos.)
1	DC Shunt motor	2
2	DC Series motor	1
3	DC shunt motor-DC Shunt Generator set	1
4	DC Shunt motor-DC Series Generator set	1
5	Single phase transformer	2
6	Three phase alternator	2
7	Three phase synchronous motor	1
8	Three phase Squirrel cage Induction motor	1
9	Three phase Slip ring Induction motor	1

ME8362 MECHANICAL ENGINEERING LABORATORY L T P C
0 0 4 2

OBJECTIVE:

- To impart practical knowledge in operating IC engines and conduct experiments. To understand test procedures in testing material for engineering applications

LIST OF EXPERIMENTS

1. Port timing diagram
2. Valve timing diagram
3. Study of 2,4 stroke I C Engines
4. Load test on 4-stroke petrol engine
5. Performance test on 4-stroke single cylinder diesel engine
6. Performance test on 4-stroke twin cylinder diesel engine
7. Heat balance test on diesel engines
8. Tension test
9. Compression test
10. Deflection test
11. Hardness test (Rockwell and Brinell)
12. Spring test
13. Torsion test
14. Impact test

TOTAL: 60 PERIODS

* Minimum 10 experiments shall be offered.

OUTCOME

- Students will be able to understand Power-generating units such as engines and operate IC engines and conduct tests. They will be able to appreciate the theory behind the functioning of engines. Material properties, their behavior under different kinds of loading and testing can be visualized.

S. No.	NAME OF THE EQUIPMENT	Qty.
1.	I.C Engine – 2 stroke and 4 stroke model	1 set
2.	4-stroke Diesel Engine with mechanical loading.	1 No.
3.	Torsion cylinder Diesel Engine	1 No.
4.	Universal Tensile Testing machine with double 1 shear attachment –	1
5.	Torsion Testing Machine (60 NM Capacity)	1
6.	Impact Testing Machine (300 J Capacity)	1
7.	Brinell Hardness Testing Machine	1
8.	Rockwell Hardness Testing Machine	1
9.	Spring Testing Machine for tensile and compressive loads (2500 N)	1

PE8491 CHEMICAL ENGINEERING THERMODYNAMICS L T P C
3 0 0 3

OBJECTIVE:

- Students will learn PVT behaviour of fluids, laws of thermodynamics, thermodynamic property relations and their application to fluid flow, power generation and refrigeration processes.

UNIT I **9**

Scope of thermodynamics, basic concepts and definitions, Equilibrium state and phase rule, Energy, Work, Temperature and Zeroth Law of Thermodynamics, reversible and irreversible process, Ideal gas- Equation of State involving ideal and real gas, Law of corresponding states, Compressibility chart, First Law of Thermodynamics and its consequences.

UNIT II **9**

Joule's experiment, internal energy, enthalpy, Application of first Law of Thermodynamics for Flow and non flow processes. Limitations of the first Law , statements of second Law of Thermodynamics and its Applications ,Heat Engine, Heat Pump/Refrigerator, Carnot cycle and Carnot theorem, Thermodynamic Temperature scale, Entropy , Clausius inequality, Third law of thermodynamics.

UNIT III **9**

Refrigeration and liquefaction process, Thermodynamic Potentials, thermodynamic correlation, Maxwell relations, criteria for Equilibria and stability. Clapeyron equation

UNIT IV **9**

Partial molar properties, ideal and non-ideal solutions, standard states definition and choice, Gibbs-Duhem equation, activity and property change of mixing, excess properties of mixtures.

UNIT V **9**

Activity coefficient-composition models, thermodynamic consistency of phase equilibria, ChemicalReaction equilibria, Extent of reaction, equilibrium constant and standard free energy change

TOTAL: 45 PERIODS

OUTCOME:

- The course will help the students to know about engineering thermodynamics and understand the practical implications of thermodynamic law in engineering design.

TEXT BOOKS:

1. Sonntag, Borgnakke, Van Wylen, Fundamentals of Thermodynamics, 7th Edition, Wiley India, New Delhi, 2009.
2. Narayanan, K.V. A Textbook of Chemical Engineering Thermodynamics Prentice Hall India, 2004
3. Smith, van Ness and Abbott, "Chemical Engineering Thermodynamics", 7th Edition, McGraw Hill, New York, 2005

REFERENCES:

1. S. I. Sandler, Chemical, Biochemical and Engineering Thermodynamics, Wiley New York, 2006
2. Y V C Rao, "Chemical Engineering Thermodynamics", Universities Press, Hyderabad 2005.
3. Pradeep ahuja," Chemical Engineering Thermodynamics", PHI Learning Ltd (2009).
4. GopinathHalder," Introduction to Chemical Engineering Thermodynamics", PHI Learning Ltd (2009).

PE8401 **GEOPHYSICS** **L T P C**

3 0 0 3

OBJECTIVE:

- To review the basic geophysical concepts as used in the petroleum industry; Applications of seismic date in the reservoir mapping and description.

UNIT I **9**

Geophysics as a tool for mapping of subsurface geological features- Introduction. Gravity and magnetism measurement methods. Gravity anomalies and their measurements. Magnetics anomalies and their measurement. Seismic methods.

UNIT II **9**

Wave theory, seismic wave reflection and refraction and their use in data acquisition. Seismic attributes- Introduction. Classification of attributes, Reservoir properties, tectonics and fault planes. Lithology, structure and Sedimentalogy.

UNIT III **9**

Land and marine geophysical methods. 2D 3D seismic methods. 3D exploration. Non conventional methods, VSP, shear waves and channel waves, seismic data processing, attribute analysis and migration techniques.

UNIT IV **9**

3D interpretation- fault recognition and mapping. Limitations on 2D fault mapping. Advantage of 3D diagram. 3D structural mapping. Stratigraphic interpretation. Analysis of direct hydrocarbon indicators.

UNIT V **9**

Reservoir evolution – Reservoir management. 4D seismic. Inversion of seismic. 4D reservoir characterization. Work stations- Introduction. Hardware and software. Work station capabilities. Display techniques. 3D visualization.

TOTAL: 45 PERIODS

OUTCOME:

- Student would be able to understand: Main geophysical methods; Wave propagation- P and S waves, Alteration at interfaces (reflection/refraction); Seismic method (data gathering and interpretation); Use and limits of seismic in reservoir description.

TEXT BOOKS:

1. S.BOYER & J.J.MARI "Seismic Surveying and Well logging"- Technip Editions, 2004.
2. J.J.MARI & E.COPPENS "Well Seismic surveying"- Technip Editions, 2003.

CY8292 CHEMISTRY FOR TECHNOLOGISTS L T P C
3 0 0 3

UNIT I UNIT PROCESSES **9**

Nitration, Sulphonation, Halogenation, Esterification, Amination, Saponification and Hydrogenation – Role of the above unit processes in such industries as petroleum, drugs, pharmaceuticals and organic synthesis.

UNIT II REACTION MECHANISMS **9**

Free radical, substitutions, electrophilic, addition, aromatic electrophilic substitutions, nucleophilic additions, condensation reactions, nucleophilic substitutions in aliphatic and aromatic compounds, cyclo-additions, rearrangements-Beckmann and Fries rearrangement reactions.

UNIT III OILS, FATS, SOAPS & LUBRICANTS **9**

Chemical constitution, Chemical analysis of oils and fats – acid, saponification and iodine values, Definitions, determinations and significance. Definition, mechanism of lubrication, preparation of petrolubes, desirable characteristics – viscosity, viscosity index, carbon residue, oxidation stability, flash and fire points, cloud and pour points, aniline point. Semisolid lubricant – greases, preparation of sodium, lithium, calcium and axle greases and uses, consistency test and drop point test. Solid lubricants – graphite and molybdenum disulphide.

UNIT IV CHEMICALS AND AUXILIARIES **9**

Preparation, properties and uses of bleaching powder, sodium hypochlorite, hydrogen peroxide, chlorine dioxide. Estimation of available chlorine in hypochlorite bleach liquor. Determination of strength of hydrogen peroxide.

UNIT V COLORANTS **9**

Theory of color and constitution: chromophore and auxochrome, classification of dyes based on application. Chemistry and synthesis of azo dye (Methyl red, Methyl orange and Congo red)

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dhara S. S., "A Text Book of Engineering Chemistry", 12th Ed., S. Chand & Co. Ltd., New Delhi, 2016.

2. Jain. P.C. and Monica Jain, “Engineering Chemistry”, Dhanpet Rai & Sons, New Delhi, 2012.
3. Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, 2015.

REFERENCES:

1. W.L. McCabe, J.C. Smith and P. Harriot, Unit Operations of Chemical Engineering, 7th Edition, McGraw Hill Education, 2005.
2. B.K. Sharma, “Industrial chemistry”, Krishna Prakashan Media (P) Ltd, Meerut, 2011.
3. Shore J., “Colourants and Auxiliaries: Volume II Auxiliaries”, Wood head Publishing Ltd., 2002.
4. Shenai V. A., “Chemistry of Dyes and Principles of Dyeing”, Sevak Publications, Mumbai, 1995.
5. Trotman E. R., “Dyeing and Chemical Technology of Textile Fibres”, B.I Publishing Pvt. Ltd., New Delhi, 1994.

PE8402 FUNDAMENTALS OF PETROLEUM GEOLOGY L T P C
4 0 0 4

OBJECTIVES:

To enable the students to

- Have basic understanding of broad array of tools used in the search for and production of hydrocarbon reserves
- Learn the principles of mapping a subsurface reservoir and estimating the volumetrics.

UNIT I **12**

Introduction to 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

UNIT II **12**

Introduction to stratigraphy - Litho – Bio- Chronostratigraphy.Geological Time Scale- Introduction to microfossils- types-Importance of Microfossils- Application of microfossil in hydrocarbon application

UNIT III **12**

Sedimentalogy of Petroleum bearing sequences- Generation and migration of Petroleum. Physical and chemical properties of Petroleum.

UNIT IV **12**

Petroleum traps- definition-types- structural –stratigraphic traps- types and classification of fold, fault, joint; unconformities and pinch outs – identification of structural and stratigraphic traps in the field and in geological section (surface and subsurface)

UNIT V **12**

Introduction to plate tectonics - sedimentary basins- types and classification of sedimentary basins- categorization of petroliferous basins of India.

TOTAL: 60 PERIODS

OUTCOME:

- Students able to understand how geologists conduct the search for petroleum resources through the value chain or the life cycle of a petroleum resource.

TEXT BOOKS:

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

REFERENCES:

1. Boggs, S., “Principles of Sedimentology and Stratigraphy”, second edition, Merrill Publishing Co., Toronto, 1995.
2. Krumblein, W.C. and Sloss, L.L., “Stratigraphy and Sedimentation”, second edition W.H. Freeman and Co., 1963.

PE8403 HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT IN PETROLEUM INDUSTRIES **L T P C 3 0 0 3**

OBJECTIVE:

- This course would expose the students to identify and assess hazards in any stage of operation, to quantify and manage them as well in petroleum industries.

UNIT I INTRODUCTION **9**

Need for developing Environment, Health and Safety systems in work places. Status and relationship of Acts, Regulations and Codes of Practice .Role of trade union safety representatives. International initiatives. Ergonomics and work place.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE **9**

Definition of the term occupational health and hygiene. Categories of health hazards. Exposure pathways and human responses to hazardous and toxic substances. Advantages and limitations of environmental monitoring and occupational exposure limits. Hierarchy of control measures for occupational health risks. Role of personal protective equipment and the selection criteria. Effects on humans, control methods and reduction strategies for noise, radiation and excessive stress.

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS **9**

Features of the satisfactory design of work premises HVAC, ventilation. Safe installation and use of electrical supplies. Fire safety and first aid provision. Significance of human factors in the establishment and effectiveness of safe systems. Safe systems of work for manual handling operations. Control methods to eliminate or reduce the risks arising from the use of work equipment. Requirements for the safe use of display screen equipment. Procedures and precautionary measures necessary when handling hazardous substances. Contingency arrangements for events of serious and imminent danger.

UNIT IV TECHNIQUES OF ENVIRONMENTAL SAFETY **9**

Elements of a health and safety policy and methods of its effective implementation and review. Functions and techniques of risk assessment, inspections and audits. Investigation of accidents- Principles of quality management systems in health and safety management. Relationship between quality manuals, safety policies and written risk assessments. Records and other documentation required by an organisation for health and safety. Industry specific EHS issues.

UNIT V EDUCATION AND TRAINING 9

Requirements for and benefits of the provision of information, instruction, training and supervision. Factors to be considered in the development of effective training programmes. Principles and methods of effective training. Feedback and evaluation mechanism.

TOTAL: 45 PERIODS

OUTCOME:

- Upon completing the course , the students understand the key issues for making petroleum production and processing, cleaner and safe.

REFERENCES:

1. Environmental and Health and Safety Management by Nicholas P. Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995
2. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007.
3. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services 2005

CH8591 HEAT TRANSFER L T P C

3 2 0 4

OBJECTIVE:

- To enable the students to learn heat transfer by conduction, convection and radiation and heat transfer equipments like evaporator and heat exchanger

UNIT I 15

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 15

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 15

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 15

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 15

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: 75 PERIODS

OUTCOMES:

At the end of this course,

- The students would have knowledge in various heat transfer methodology in process engineering.
- To design heat transfer equipments such as furnace, boilers, heat exchangers evaporation

TEXT BOOKS:

1. Holman, J. P., 'Heat Transfer ', 8th Edn., McGraw Hill, 1997.
2. Ozisik, M. N., Heat Transfer: A Basic Approach, McGraw-Hill, 1984
3. Kern, D.Q., "Process Heat Transfer ", McGraw-Hill, 1999.

REFERENCES:

1. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 6th Edn., McGraw-Hill, 2001.
2. Coulson, J.M. and Richardson, J.F., "Chemical Engineering " Vol. I, 4th Edn., Asian Books Pvt. Ltd., India, 1998.

PE8461 FLUIDS AND SOLID OPERATIONS LABORATORY LT P C
0 0 4 2

OBJECTIVES:

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

LIST OF EXPERIMENTS - Phase – I(minimum 5 Experiments to be conducted)

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(minimum 5 Experiments to be conducted)

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
9. Drop weight crusher
10. Drag on Sphere
11. Effectiveness of screen

EQUIPMENT REQUIRED

1. Sieve shaker
2. Leaf filter
3. Plate and Frame Filter Press
4. Sedimentation Jar
5. Jaw Crusher
6. Ball Mill
7. Cyclone Separator
8. Roll Crusher
9. Elutriator
10. Drop Weight Crusher
11. Sieves.

TOTAL: 60 PERIODS

OUTCOMES:

- Use variable area flow meters and variable head flow meters
- 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.
- Determine work index, average particle size through experiments by crushers, ball mill and conducting sieve analysis.
- Design size separation equipments such as cyclone separator, sedimentation, Filters etc.

CH8281	**CHEMICAL ANALYSIS LABORATORY**	**L T P C**
	(Minimum of 8 experiments to be conducted)	**0 0 4 2**

OBJECTIVE:

- To make the student acquire practical skills in the wet chemical and \ instrumental methods for quantitative estimation of nitrite in water, cement, oil, coal and Phenol.

LIST OF EXPERIMENTS

1. Determination of Redwood / Saybolt numbers, kinematic viscosity and viscosity index of Lubricating oils
2. Determination of flash point, fire point, cloud and pour point of oils
3. Determination of acid value and iodine value of oils
4. Determination of COD of water samples
5. Cement Analysis a. Estimation of silica content b. Estimation of mixed oxide content c. Estimation of calcium oxide content d. Estimation of calcium oxide by rapid method
6. Coal Analysis a. Estimation of sulphur present in coal b. Ultimate analysis of coal c. Proximate analysis of coal
7. Soap Analysis a. Estimation of total fatty acid b. Estimation of percentage alkali content

8. Flue gas analysis by Orsat's apparatus
9. Estimation of phenol.
10. Determination of calorific value using bomb calorimeter
11. Determination of nitrite in water.

S. No.	Description of Equipment	Quantity required
1	Silica Crucible	20
2	Heating Mantle	3
3	Muffle Furnace	1
4	Hot air oven	1
5	Desiccator	5
6	Vacuum Pump	1
7	Condenser	10
8	Reflux Condenser	10
9	Pensky martens closed cup apparatus	1
10	Cleveland Open cup apparatus	1
11	Cloud point apparatus	1
12	Saybolt Viscometer	1
13	Redwood Viscometer	1
14	Bomb Calorimeter	1
15	COD reflux	1
16	Orsat apparatus	1
17	UV-Vis Spectrophotometer	1

TOTAL: 60 PERIODS

OUTCOMES:

- Familiarization with equipment like viscometers, flash and fire point apparatus etc
- Familiarization of methods for determining COD
- Familiarization of a few simple synthetic techniques for soap

REFERENCES:

1. Environmental pollution analysis, S.M.Khopkar, New age international. 2011
2. Manual of environmental analysis, N.C Aery, Ane books. 2010
3. Text book of quantitative chemical analysis, J.Mendham, Pearson education 2008

PE8501 PROCESS CONTROL AND INSTRUMENTATION L T P C
3 2 0 4

OBJECTIVE:

- To know about control methods and make the students knowledgeable in various types of measuring instruments used in chemical process industries.

UNIT I INSTRUMENTATION 15

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 15

Laplace transformation and its application in process control. 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 15

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 15

Introduction to frequency response of closed-loop systems, control system design by frequency response techniques, Bode diagram, stability criterion, tuning of controllers Z-N tuning rules, C-C tuning rules.

UNIT V ADVANCED CONTROL SYSTEMS 15

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

TOTAL: 75 PERIODS

OUTCOME:

- Upon completing the course, the student should have understood controller tuning ,type of controller that can be used for specific problems in chemical industry and design of controllers for interacting multivariable systems.

TEXT BOOKS:

1. Stephanopoulos, G., “Chemical Process Control“, Prentice Hall of India, 2003.
2. Coughnowr, D., “Process Systems Analysis and Control “, third Edition., 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”, Third Edition, John Wiley, New York, 2005.
3. Jason L. Speyer, Walter H.Chung, ”Stochastic Processes, Estimation, and Control”, PHI Ltd (2013).

PE8502 MASS TRANSFER L T P C

3 2 0 4

OBJECTIVE:

- To provide a basic introduction to the physical and thermodynamic principles of mass transfer with an emphasis on how these principles affect the design of equipment and result in specific requirements for quality and capacity.

UNIT I ABSORPTION 15

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 II DISTILLATION 15

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 III LIQUID-LIQUID EXTRACTION 15

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 IV LEACHING 15

Solid-liquid equilibria- leaching equipment for batch and continuous operations- calculation of number of stages - Leaching - Leaching by percolation through stationary solid beds, moving bed leaching, counter current multiple contact (shank's system), equipments for leaching operation, multi stage continuous cross current and counter current leaching, stage calculations, stage efficiency.

UNIT V ADSORPTION AND ION EXCHANGE & MEMBRANE SEPARATION PROCESS 15

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: 75 PERIODS

OUTCOME:

- On completion of this course, the students would learn to design absorber and stripper, distillation column, extraction and leaching equipments and adsorber.

TEXT BOOKS:

1. Wankat, P., "Equilibrium Stage Separations", Prentice Hall, 1993.
2. Treybal, R.E., "Mass Transfer Operations ", 3rd Edn., McGraw-Hill, 1981.
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 Edn., McGraw-Hill, 2005.

PE8503 **RESERVOIR ENGINEERING I** **L T P C**
4 0 0 4

OBJECTIVES:

To enable the students to

- Understand the rock and fluid properties of a hydrocarbon reservoir
- Describe the nature of the fluid flow and pressure distribution in a reservoir
- Understand the effects of production/ injection on recovery of reserves

UNIT I **12**

Introduction to Reservoir Engineering, Basic principles, definitions and data – Reservoir fluids, oil, gas, Gas formation volume factor, oil formation, volume factor, water formation volume factor – oil, gas water, rock compressibility – Resistivity index, wettability and contact angle, effective permeability characteristics, capillary pressure curves – Resistivity factors and saturation exponents. Fluid PVT analysis and oil gas phase behaviour.

UNIT II **12**

Formation evaluation – General material balance equations in oil or combination reservoirs, predicting primary recovery in solution – Gas Drive, Reservoirs. Definition and classification of Reserves – methods of estimating Reserves – Production decline cures. Secondary Recovery – pressure maintenance – gas injection – water injection – spacing of wells and well patterns – peripheral or central flooding.

UNIT III **12**

Fluid flow in reservoirs, Fluid movement in water flooded Reservoirs – Recovery efficiency – Areal or pattern. Sweep efficiency, - Vertical or invasion sweep efficiency, - Permeability variation – Cross flow – Estimates of volumetric sweep efficiency – Estimation of water flood recovery by material balance – prediction methods – Monitoring injectivity. Darcy Law and application.

UNIT IV **12**

Recommended methods for assessing residual oil – Existing wells, new wells, Chemical Flooding, Gas injection, Thermal recovery – Well Testing.

UNIT V **12**

Well inflow equations for stabilized flow conditions. Constant terminal rate solution of the radial diffusivity equation and its application to oil well testing**.**

TOTAL: 60 PERIODS

OUTCOME:

- Students will understand the location, formation, fluid content of a hydrocarbon reservoir; understand the definitions of reserves; be aware of the role of reservoir engineering in exploration and development

TEXT BOOKS:

1. L.P. Dake L Elsevier, “Fundamentals of Reservoir Engineering”, Development in Petroleum Science. 1980
2. Craft, B.C. and Hawkins M.F. revised by Ronald E. Terry and J. Brandon Rogers “Applied Petroleum Reservoir Engineering” third edition, Prentice-Hall (2014)

REFERENCES:

1. Dake, L.P. Practice of Reservoir Engineering Elsevier 2001
2. William C.Lyons, Gary J.Plisga “Standard Hand Book of Petroleum &Natural Gas Engineering” Second Edition – (Elsevier), Gulf Publishing, Burlington U.S.A (2005).

HS8581 **PROFESSIONAL COMMUNICATION** **L T P C**
0 0 2 1

OBJECTIVES:

The couse aims to:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully

UNIT I

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -– questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

TOTLA: 30 PERIODS

OUTCOMES:

At the end of the course Learners will be able to:

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software

1. Globearena
2. Win English

REFERENCES:

1. Butterfield, Jeff **Soft Skills for Everyone.** Cengage Learning: New Delhi, 2015
2. **Interact** English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
3. E. Suresh Kumar et al. **Communication for Professional Success.** Orient Blackswan: Hyderabad, 2015
4. Raman, Meenakshi and Sangeeta Sharma. **Professional Communication**. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. **Soft Skills**. MJP Publishers: Chennai, 2010.

CH8561 **HEAT TRANSFER LABORATORY** **L T P C**
0 0 4 2

OBJECTIVE:

- To enable the students to develop a sound working knowledge on different types of heat transfer equipments.

LIST OF EXPERIMENTS

1. Heat Transfer in a Double Pipe Heat Exchanger
2. Heat transfer in Shell and Tube Heat Exchanger
3. Heat Transfer in a Bare and Finned Tube Heat Exchanger
4. Heat transfer in composite wall
5. Heat transfer by Forced / Natural Convection
6. Heat Transfer by Radiation - Determination of Stefan Boltzmann constant
7. Heat Transfer by Radiation - Emissivity measurement
8. Heat transfer in Open Pan Evaporator
9. Heat transfer by Single effect evaporation / Multiple effect evaporation
10. Boiling Heat Transfer
11. Heat Transfer through Packed Bed
12. Heat Transfer in a Horizontal Condenser / Vertical Condenser
13. Heat Transfer in Helical Coils
14. Heat Transfer in Agitated Vessels

TOTAL: 60 PERIODS

Minimum 10 experiments to be offered

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

1.	Double Pipe Heat Exchanger	1 No.
2.	Shell and Tube heat exchanger	1 No.
3.	Bare and Finned Tube Heat Exchanger	1 No.
4.	Composite wall set up	1 No.
5.	Natural convection set up or Forced convection set up	1 No.
6.	Stefan Boltzmann Apparatus	1 No.
7.	Emissivity measurement set up	1 No.
8.	Open Pan Evaporator	1 No.
9.	Single effect evaporator or Multiple effect evaporator	1 No.
10.	Boiler	Compulsory equipment
11.	Packed Bed	1 No.
12.	Vertical Condenser or Horizontal Condenser	1 No.
13.	Helical Coil	1 No.
14.	Agitated Vessel	1 No.
15.	Jacketed vessel	1 No.

Any 10 equipment excluding boiler

OUTCOME:

- Student would be able to calculate heat transfer by conduction, different types of convection using classical models for these phenomena.

PE8511 **GEOLOGY LABORATORY** **L T P C**
0 0 4 2

OBJECTIVE:

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

LIST OF EXPERIMENTS

1) Calculation of True and Apparent Dip.
2) Estimation of Thickness, Distance and Depth of the ore body.
3) Estimation of Throw and Nature of the fault.
4) Interpretation of surface Geology using contour maps.
5) Sand – Silt – Clay ratio estimation.
6) Grain – Size analysis.
7) Identification of important sedimentary rocks in hand specimen.
8) Identification of important sedimentary rocks in microscopic level

TOTAL: 60 PERIODS

OUTCOME:

- Students will be able to understand the preparation of Geological maps and identify the rock specimens by Megascopic and Microscopic, Identify the Depositional environment and Sediment types.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

1) Sieve Shakers
2) Sieves set.
3) Petrological Microscopes
4) Hot even
5) 1000 ml and 50 ml beakers

PE8601 **WELL DRILLLING EQUIPMENT AND OPERATION** **L T P C**
3 0 0 3

OBJECTIVE:

- To make the students learn about the Drilling Process and Drilling Equipments**.**

UNIT I **9**

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

UNIT II **9**

Components- Overall Drilling Rig, Drilling Sub systems – Mud circulation system – Power – Hoisting Line – speeds and Loads Power – Loading Components – Drill Pipe, Heavy Weight Drill Pipe (HWDP), Drill String Loads - Bottom hole assembly-Drilling Assembly

UNIT III **9**

Directional Drilling, Well Planning, Two Dimensional, Horizontal, Tools, Techniques, MWD,surveying, 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

OUTCOME:

- Students will understand the concepts and techniques used in well drilling. They will learn the design requirements of well planning and construction. Students would be able to optimize the design of a drilling program

TEXT BOOKS:

1. Rabia.H. 'Oil Well Drilling Engineering, Principles And Practices' Graham And Trotman Ltd. 1985.
2. D.P Helander 'Fundamentals Of Formation Evaluation'

REFERENCE:

1. Standard Handbook of Petroluem and Natural Gas Engineering, 2nd Edition, William C Lyons, Gary C Pilisga, Gulf Professional Publishing

PE8602 **WELL LOGGING** **L T P C**
4 0 0 4

OBJECTIVE:

- To enable the students to understand the concept of formation evaluation and well logging and techniques involved in it.

UNIT I **12**

Aims and objectives of well logging. Reservoir formations. Borehole conditions. Fundamental concepts in borehole geophysics physical properties of reservoir rocks. Formation parameters and their relationships: formation factor, porosity, permeability, resistivity, water and hydrocarbon saturations, and movable oil. Archie's and Humbles equations.

UNIT II **12**

Principles, instrumentation, operational procedures and applications of different geophysical logs: S.P., electrical, induction, nuclear, sonic, caliper, temperature, dip and direction. Natural gamma ray spectrometry log, nuclear magnetic log, litho density log, neutron activation technique, thermal neutron decay time log, chlorine and oxygen logs.

UNIT III **12**

Recording, transmission and processing of log data. Formation evaluation for hydrocarbons. Qualitative and quantitative interpretations of well log data. Overlays and cross-plots. Determination of reservoir parameters – porosity, resistivity, permeability, water and hydrocarbon saturation, movable oil. Lithology determination by neutron, density and sonic cross-plots, dual mineral method, triporosity method, litho porosity cross-plot (M-N plot), clean sand and shaly sand interpretations.

UNIT IV **12**

Sub-surface correlation and mapping from log data. Delineation of fractures from logs. Production logging. Well logging for metallic and non-metallic minerals: radioactive and non-radioactive evaporates, coal, sulphur. Borehole geophysics for groundwater exploration. Effective pay thickness of an aquifer. Saline water-fresh water interface from log data. Determination of groundwater flow direction by logs.

UNIT V **12**

Theoretical computations of normal and lateral log responses. Identification and delineation of sub-surface formations from well log data. Calculation of reservoir parameters: formation factor, porosity, permeability, resistivity, water and hydrocarbon saturations, and movable oil. Sub-surface correlation of formations and interpretation of field data.

TOTAL: 60 PERIODS

OUTCOME:

- Students able to understand the physical principles of the tools used in logging. They can characterize the formation based on interpretation of well logs

TEXT BOOKS:

1. Standard Handbook of petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing.
2. D.P Helander 'Fundamentals Of Formation Evaluation'
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, 1984, ISBN 04441327.

PE8603 **RESERVOIR ENGINEERING II** **L T P C**

4 0 0 4

OBJECTIVE:

- To enable the student to interpret cross plots, well characteristics, simulation and gas condensate reservoirs.

UNIT I **12**

Fluid characteristics. Introduction to the production system. Characteristics of the reservoir rocks-Porosity, Permeability- cross plots. Fluid saturation, capillary pressure**.**

UNIT II **12**

Well testing – Basic well testing theory – oil well testing: gas well testing – Practical well testing – Gas field reservoir engineering – Fluid phase behaviour – Gas in place volumes and recovery estimations. Reservoir testing and performance analysis: well test – drill stem tests (DST); production tests, pressure tests on gas wells; formation interval testing and other well testing techniques. Conning of water and gas; effects of partial penetration.

UNIT III **12**

Multi phase flow: Relative permeability-fractional flow. Well performance – inflow performance, tubing performance.

UNIT IV **12**

Material balance techniques: Production forecasting – Gas condensate reservoir engineering Fluid phase behaviour development – options.

UNIT V **12**

Well performance – Reservoir management and simulation – reservoir data acquisition – Reservoir simulation. Mathematical basis of bottom hole analysis; Differential equations for radial flow in a porous medium. Pressure draw down and build up analysis.

TOTAL: 60 PERIODS

OUTCOME:

- Student will be able to follow and understand the reservoir concepts such as reservoir simulation, rock characteristics and reservoir management.

TEXT BOOKS:

1. Amyx.J.W. et al. "Petroleum reservoir engineering" – Mc.Graw-hill-1998.
2. Archer.J.s and Wall C.C. "Petroleum engineering principles and practice", kluwer 1990.

REFERENCE:

1. Craft, B.C. and Hawkins M.F. revised by Ronald E. Terry and J.Brandon Rogers "Applied Petroleum Reservoir Engineering" third edition, Prentice-Hall (2014)

GE8076 **PROFESSIONAL ETHICS IN ENGINEERING** **L T P C**

3 0 0 3

OBJECTIVE:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES **10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES **8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, 2009.
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, ‘ Value Education’, Vethathiri publications, Erode, 2011.

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

PE8604 DRILLING FLUIDS AND CEMENTING TECHNIQUES L T P C
3 0 0 3

OBJECTIVE:

- To enable the students to understand the types of drilling fluids and cementing techniques

UNIT I **9**

Introduction to the basic functions and properties of drilling fluids and cement slurries. Compositions and related properties of drilling fluids and cement slurries.

UNIT II **9**

Drilling fluids – classification – water base drilling fluids. Testing of drilling fluids. Drilling fluid additives**.**

UNIT III **9**

Types of equipment and methods used in cementing operations. Drilling fluid and cement slurry hydraulics.

UNIT IV **9**

Determination of torque and drag. Calculation of cutting transport efficiency. Placement technique of cements. Gas migration through cement columns.

UNIT V **9**

Will cementing – chemistry of cements. Cementing principles – primary cementing, secondary cementing, linear cementing, plug cementing, and single stage cementing, multistage casing cementing.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students would have

- Learned the concepts and applications of drilling fluids
- Learned the equipments involved in the cementing operations

TEXT BOOKS:

1. Rabia.H. 'Oil Well Drilling Engineering, Principles And Practices' Graham And Trotman Ltd. 1985.
2. Smith.P.K, 'Cementing' SPE Pulications 2nd Edition 1976.
3. Cementing Technology – Powel Schlumberger Publication 1984.

REFERENCES:

1. Mc.Cray. A.W and Cole.F.W. 'Oil Well Drilling Technology' University of Oklahoma Press, Norman 1959.
2. Standard Handbook of petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Profession.

CH8781 **MASS TRANSFER LABORATORY** **L T P C**
0 0 4 2

OBJECTIVE:

- To train the students to develop sound working knowledge on different types of mass transfer equipments.

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. Water purification using ion exchange columns
10. Mass transfer characteristics of Rotating disc contactor
11. Estimation of mass/heat transfer coefficient for cooling tower
12. Surface evaporation
13. Adsorption studies
14. Leaching studies
15. Demonstration of Gas – Liquid absorption

*Minimum 10 experiments shall be offered.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

1. Simple distillation setup 1 No.
2. Steam distillation setup 1 No.

3.	Packed column	1 No.
4.	Liquid-liquid extractor	1 No.
5.	Vacuum Dryer	1 No.
6.	Tray dryer	1 No.
7.	Rotary dryer	1 No.
8.	Ion exchange column	1 No.
9.	Rotating disc contactor	1 No.
10.	Cooling tower	1 No.
11.	Absorption column	1 No.
12.	Surface evaporation set up	1 No.
13.	Adsorption column set up / Adsorption studies using conical flask	1 No.
14.	Leaching column set up / Leaching studies using conical flask	1 No.

Any 10 equipment

OUTCOME:

- Students would be able to determine important data for the design and operation of the process equipments like distillation, extraction, diffusivity and drying principles which are having wide applications in various industries

PE8661 **PETROLEUM TESTING LABORATORY** **L T P C**
0 0 4 2

OBJECTIVE:

- To make the student to be conversant with the theoretical principles and experimental procedures for quantitative estimation of petroleum products.

LIST OF EXPERIMENTS

1. Fluid viscosity determination
2. Carbon residue determination
3. Karl-Fisher Conductometer Apparatus for water estimation
4. Fluid density
5. Aniline point
6. Corrosion testing of petroleum oils and copper
7. Freezing point of Aqueous Engine coolant solution
8. Automatic Distillation
9. Fire point- Flash point
10. Gas Colorific value determination
11. liquid or solid Colorific value determination
12. Smoke point determination
13. Cloud and pour point determination
14. Softening point determination
15. Ductility of bitumen
16. Penetration index determination

TOTAL:60 PERIODS

OUTCOMES:

- Perform the various physical and chemical properties of the petroleum products in a safe manner.
- Differentiate various petroleum products by performing the specific tests.

- Perform the advanced qualitative and quantitative laboratory tasks, including the operation of advanced analytical instrumentation.

LIST OF EQUIPMENT

1. Redwood / Saybolt / Engler viscometer
2. Conradson Apparatus
3. Muffle furnace
4. Hydrometer
5. Aniline point apparatus
6. Copper corrosion Apparatus
7. Freezing / Cloud / Pour point apparatus
8. Junkers Gas Calorimeter / Bomb Calorimeter
9. Cleveland / PenskyMartien open and closed cup Flash and fire point Apparatus
10. API Distillation Apparatus
11. Abbey Refractometer
12. Dean and Stark apparatus
13. Karl –Fisher Apparatus
14. Softening point apparatus
15. Ductilometer
16. Penetrometer

PE8701 PETROLEUM PRODUCTION ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To provide knowledge of production operations in the oil and gas wells such as artificial lifts and subsurface equipments.

UNIT I **9**

Components of the petroleum systems. Well productivity engineering. Production from under saturated oil reservoirs. Production from two-phase reservoirs. Production from gas reservoirs. Pseudo critical properties of natural gases. Gas well deliverability for non – Darcy flow.

UNIT II **9**

The near-well bore condition and damage characterization, the effect of perforation conditions on well performance. Well bore flow performance. Well deliverability. Well head surface gathering systems. Artificial lift systems. Horizontal well production. System analysis. Production Chemistry Basics (Wax, Scale, Corrosion, Emulsions).

UNIT III **9**

Surface equipment and operations. Flow control and well heads. Gathering systems; service and cleaning systems; design and testing of flow lines. Separation and separators; separator components, stage separation; design and construction of separators. Meeting - Oil and gas metering techniques.

UNIT IV **9**

Flow measurement system; liquid level controllers. Emulsion problems; oil emulsions; emulsifying agents and de-emulsifiers, choice and dosage of de-emulsifiers, heat treatment, heat treaters, desalting, oil storage and tank farms. Gauging, sampling and quality control. Underground storage – caverns etc. Water disposal, corrosion. Water injection systems. Subsurface equipment**.**

UNIT V **9**

Well completion techniques and equipment, drill stem test (DST) flowing well performance, vertical lift performance, optimum size tubing and chokes, production forecast for a pool. Design and analysis of artificial methods of petroleum production. Work over and sand exclusion technique**.**

TOTAL: 45 PERIODS

OUTCOME:

- Student will be able to understand the basics of oil and gas production engineering techniques.

TEXT BOOKS:

1. "Gas Production Engineering" – S.Kumar-Gulf publishing Co., - 1987.
2. T.E.W.Nind"Principles of well Produciton"-2nd Edition.Mc.Graw hill Book-Co. Ltd, Newyork 1981. ISBN 0070465762.

REFERENCE:

1. T.O.allen and A.P.Roberts. "Production operations" –SPE - Vol-I 4-th edition

GE8291 ENVIRONMENTAL SCIENCE AND ENGINEERING **L T P C**
3 0 0 3

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth‟s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

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 – biogeographical 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 – solid

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 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 production 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:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS:

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, ‘Introduction to Environmental Engineering and Science’, 2nd edition, Pearson Education, 2004.

REFERENCES:

1. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD,New Delhi,

2007.
2. Erach Bharucha, “Textbook of Environmental Studies”, Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, “Environmental Science”, Cengage Learning India PVT, LTD, Delhi, 2014.

PE8711 DRILLING FLUIDS AND CEMENTING TECHNIQUES LABORATORY L T P C
0 0 4 2

OBJECTIVE:

- To demonstrate the processes involved in drilling and cementing operations, introduce laboratory techniques which are used to select and optimize drilling fluids and cement slurry and to develop interest in experimentation.

LIST OF EXPERIMENTS

1) Drilling Fluid properties measurements using: Mud balance – Determination on density or weight of a drilling mud.
2) Determination of thickening time of cement slurry.
3) Determination and measurement of fluid loss of a drilling fluid and mud cake properties of a drilling fluid using atmospheric filter press.
4) Determination and measurement of fluid loss of cement slurry using atmospheric filter press.
5) Determination of rheology of drilling fluid by Fann viscometer.
6) Determination of rheology of cement slurries using Fann viscometer.
7) pH.
8) Measurement and control of the basic properties of drilling fluids (density, viscosity, filtration, lubricity and electrochemical properties) and cement slurries (density, viscosity, filtration, thickening time and mechanical properties).
9) Determination of compressive strength of cement slab.

TOTAL: 60 PERIODS

OUTCOME:

- Students able to understand the drilling fluid equipment, Principles and operation and oil well cement properties.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

1) Mud balance
2) Picnometer and F.G.T meter
3) Atmospheric Filter press.
4) pH meter
5) Compact Curing chamber
6) Fann viscometer
7) cement compressive strength testing machine
8) Hamilton Beach Mixer

PE8712 **INTERNSHIP** **L T P C**
0 0 0 2

Students shall undergo training in R&D institutions / Academics / Industries for a minimum period of 15 days. At the end of internship students must submit a report for internal evaluation.

PE8811 **PROJECT WORK** **L T P C**
0 0 20 10

OBJECTIVE:

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

Each student is required to submit a report on the project assigned to him by the department. The report should be based on the information available in the literature or data obtained in the laboratory/industry.

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.

PE8812 **SEMINAR** **L T P C**
0 0 4 2

The Objective of the comprehension test is to assess the overall level of proficiency and the scholastic attainment of the student in the various subjects studied during the degree course.

PE8091 **CHEMICAL REACTION ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVE:

- To enable the students to gain knowledge on different types of chemical reactors, the design of chemical reactors under isothermal and non-isothermal conditions

UNIT I **9**

Rate equation, elementary, non-elementary reactions, theories of reaction rate and Prediction; Design equation for constant and variable volume batch reactors, analysis of experimental kinetics data, integral and differential analysis.

UNIT II **9**

Design of continuous reactors - stirred tank and tubular flow reactor, recycle reactors, Equal sized CSTRs in series and parallel, Equal sized PFRs in series and parallel,size comparison of reactors.

UNIT III **9**

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

UNIT IV **9**

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 V **9**

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

TOTAL: 45 PERIODS

OUTCOME:

- At the end of this course, the students would gain knowledge on the selection of reactor for the required 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., 3rd Edition, 2000.

REFERENCE:

1. Froment. G.F. &K.B.Bischoff, "Chemical Reactor Analysis and Design", John Wiley and Sons, 1979.

CH8075 PETROLEUM REFINING AND PETROCHEMICALS **L T P C**
3 0 0 3

OBJECTIVE:

- Students will gain knowledge about petroleum refining process and production of petrochemical products

UNIT I **9**

Origin, Formation and Evaluation of Crude Oil. Testing of Petroleum Products. Refining of Petroleum – Atmospheric and Vaccum Distillation.

UNIT II **9**

Cracking, Thermal Cracking, Vis-breaking, Catalytic Cracking (FCC), Hydro Cracking, Coking and Air Blowing of Bitumen.

UNIT III **9**

Treatment Techniques: Removal of Sulphur Compounds in all Petroleum Fractions to improve performance, Solvent Treatment Processes, Dewaxing, Clay Treatment and Hydrofining.

UNIT IV **9**

Cracking of Naphtha and Feed stock gas for the production of Ethylene, Propylene, Isobutylene and Butadiene. Production of Acetylene from Methane, Catalytic Reforming of Petroleum Feed Stocks and Extraction of Aromatics.

UNIT V **9**

Production of Petrochemicals like Dimethyl Terephathalate (DMT), Ethylene Glycol, Synthetic Glycerine, Linear Alkyl Benzene (LAB), Acrylonitrile, Methyl Methacrylate (MMA), Vinyl Acetate Monomer, Phthalic Anhydride, Maleic Anhydride, Phenol and Acetone, Methanol, Formaldehyde, Acetaldehyde, Pentaerythritol and Production of Carbon Black.

TOTAL: 45 PERIODS

OUTCOMES:

- Understand the classification, composition and testing methods of crude petroleum / product to develop innovative refining process and develop quality control and assurance techniques.
- Apply the knowledge of treatment processes to develop the manufacture of petroleum products.

TEXT BOOKS:

1. Nelson, W. L., "Petroleum Refinery Engineering", 4th Edn., McGraw Hill, New York, 1985.
2. Bhaskara Rao, B. K., "Modern Petroleum Refining Processes", 2nd Edn., Oxford and IBH Publishing Company, New Delhi, 1990.
3. Bhaskara Rao, B. K. "A Text on Petrochemicals", 1st Edn., Khanna Publishers, New Delhi, 1987.
4. Wiseman. P., Petrochemicals, UMIST Series in Science and Technology.
5. H. Steiner, Introduction to petrochemicals Industry', Pergamon, 1961.

PE8092 NATURAL GAS ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- Enable the students to learn the basic concept and applications of Natural Gas Engineering.

UNIT I **9**

Natural gas technology and earth science: Branches of petroleum Industry. Sources of Information for natural gas engineering and its applications. Geology and earth sciences: Earth sciences-Historical geology, Sedimentation process, Petroleum reservoirs, Origin of petroleum. Earth temperatures & pressure, Earth temperatures, Earth pressure. Petroleum: Natural gas, LP gas, Condensate, & Crude oil.

UNIT II **9**

Properties of Natural Gases: typical compositions. Equations of state: general cubic equations, specific high accuracy equations. Use of equation of state to find residual energy properties, gas measurement gas hydrates, condensate stabilization, acid gas treating, gas dehydrations, compressors, process control deliverability test, gathering and transmission, and natural gas liquefaction.

UNIT III **9**

Gas Compression: Positive displacement and centrifugal compressors; fans. Calculation of poser requirements. Compressible Flow in Pipes: Fundamental equations of flow: continuity, momentum, elegy equations.

UNIT IV **9**

Isothermal flow in pipes: the Weymouth equation. Static and flowing bottom-hole pressures in wells. Fundamentals of Gas flow in porous media: Steady state flow equations. Definition of pseudo-pressure function. Gas flow in cylindrical reservoirs: general equation for radial flow of gases in symmetrical homogeneous reservoirs.

UNIT V **9**

Non-dimensional forms of the equation; derivation of coefficients relation dimensionless to real variables. Infinite reservoir solution: Pseudo-steady-state solution. Gas Well Deliverability Tests:

Flow-after-flow tests: prediction of IPR curve and AOF for the well. Isochronal tests. Draw down tests: need for data at two flow rates.

TOTAL: 45 PERIODS

OUTCOME:

- Students will be able to understand the Natural gas processing, Gas Compression, Gas Gathering and Transport Installation, Operation and trouble shooting of natural gas pipelines.

TEXT BOOK:

1. Katz D.L.et al., Natural Gas Engineering (Production & storage), McGraw-Hill, Singapore.

REFERENCE:

1. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing.

PE8001 PRINCIPLES OF GEOCHEMISTRY L T P C
3 0 0 3

OBJECTIVES:

Student will learn about the concepts of

- Geochemical dispersion, and the principles of trace element analysis
- Geochemical soil surveys.

UNIT I **9**

Earth in relation to Universe – Nature, age, and Composition of Universe, Nature, Age and Composition of Sun, Basic Principles of Geochemistry – Geochemical environment – Geochemical dispersion – Geochemical Mobility – Mineral stability – Trace Elements in Minerals – Goldschmidt's Classifications – Geochemical Tracers – Geochemical anomaly – Primary Differentiation of the Earth.

UNIT II **9**

Principles of trace element analysis - Preparation, decomposition and separation of samples – Estimation of trace elements in Samples - Gravimetry – colorimetry – Turbidity – Spot Tests – Paper chromatography – Visible Fluorescence – Flame Spectrometry – X-Ray spectrometry – Geochemcial Provinces

UNIT III **9**

Secondary Dispersion: Chemical and biochemical factors – Hydrogen ion concentrations – Redox stability of secondary minerals – Mode of occurrence of solute – Sorptive capacity of solids – Stability of colloidal dispersion – Metallo – Organic Compounds - Effects of Vegetation

UNIT IV **9**

Anomalies in Natural waters: Mode of occurrence of elements – persistence of anomaly – contrast at source – Decay by dilution – Decay on precipitation – ground water, seawater and lake water anomalies

UNIT V **9**

Geochemical Soil surveys, orientation survey – Residual soil, Transported Soil, Contaminations – Sampling Patterns and procedures – Sample preparations – Preparation and Interpretations of Geochemical Maps.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students would
- Gain knowledge on the principles and concepts of geochemistry
- Select appropriate techniques to obtain information on the chemical composition of sedimentary rocks and fluids such as oils and gases

TEXT BOOKS:

1. Mason, B. and Moore, C.B., “Introduction to Geochemistry”, Wiley Eastern, 1991.
2. Faure, G., 1986, Principles of isotope Geology., John Wiley.

REFERENCES:

1. Hoefs, J., “Stable Isotope Geochemistry”., Springer Verlag, 1980.
2. Krauskopf, K.B., “Introduction to geochemistry”, McGraw Hill, 1967.

GE8071 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- 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

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

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXT BOOKS:

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.

PE8071 ADVANCED SEPARATION TECHNIQUES L T P C

3 0 0 3

OBJECTIVE:

- To learn the principle and technical concept of advanced separation processes.

UNIT I BASICS OF SEPARATION PROCESS 9

Review of Conventional Processes, Recent advances in Separation Techniques based on size, surface properties, ionic properties and other special characteristics of substances, Process concept, Theory and Equipment used in cross flow Filtration, cross flow Electro Filtration, Surface based solid – liquid separations involving a second liquid.

UNIT II MEMBRANE SEPARATIONS 9

Types and choice of Membranes, Plate and Frame, tubular, spiral wound and hollow fiber

Membrane Reactors and their relative merits, commercial, Pilot Plant and Laboratory Membrane permeators involving Dialysis, Reverse Osmosis, Nanofiltration, Ultra filtration and Micro filtration, Ceramic- Hybrid process and Biological Membranes.

UNIT III SEPARATION BY ADSORPTION 9

Types and choice of Adsorbents, Adsorption Techniques, Dehumidification Techniques, Affinity Chromatography and Immuno Chromatography, Recent Trends in Adsorption.

UNIT IV INORGANIC SEPARATIONS 9

Controlling factors, Applications, Types of Equipment employed for Electrophoresis, Dielectrophoresis, Ion Exchange Chromatography and Eletrodialysis, EDR, Bipolar Membranes.

UNITV OTHER TECHNIQUES 9

Separation involving Lyophilisation, Pervaporation and Permeation Techniques for solids, liquids and gases, zone melting, Adductive Crystallization, other Separation Processes, Supercritical fluid Extraction, Oil spill Management, Industrial Effluent Treatment by Modern Techniques.

TOTAL: 45 PERIODS

OUTCOME:

- Fully understand key concepts of separation processes including equilibrium stages, reflux, countercurrent contacting, limiting cases, efficiency and mass transport effects.

TEXT BOOKS:

1. Schoen, H.M., "New Chemical Engineering Separation Techniques", Interscience Publishers,1972.
2. Treybal, R.E., "Mass Transfer Operations", 3rd Edition, McGraw Hill Book Co., 1980.

REFERENCES:

1. King, C. J., "Separation Processes", Tata McGraw Hill, 1982.
2. Roussel, R. W., "Handbook of Separation Process Technology", John Wiley, New York, 1987
3. Nakagawal, O. V., "Membrane Science and Technology"' Marcel Dekkar, 1992.

PE8002 WELL COMPLETION TESTING AND WORK OVER L T P C

3 0 0 3

OBJECTIVE:

- To provide insights into the Well Operation during the hydrocarbon Explorations.

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

Drilling methods and equipment for directional, horizontal and multilateral wells. Selection of casing shoes, material properties and design of casing program**,** perforation, skin effect, activation.

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. well stimulation.

UNIT IV **9**

Well stimulation and work over 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

OUTCOME:

- Student will be able to understand the basics and operations of Well Completion techniques.

TEXT BOOKS:

1. Wellsite Geological Techniques for Petroleum exploration by Sahay .B. et al
2. Petroleum Exploration Hand Book by Moody, G.B.

REFERENCE:

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

PE8072 CATALYTIC REACTION ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on different types of chemical reactors, the design of chemical reactors under isothermal and non-isothermal conditions

UNIT I CATALYST AND ITS CHARACTERIZATION **9**

General definition of catalysts, Solid catalysts, Components of catalyst, Industrial catalysts, Preparation of solid catalysts, Precipitation and co-precipitation methods, Sol gel method, Supported catalysts,Impregnation and ion exchange method, Catalyst drying calcination and formulations, Catalyst Characterization techniques, Structural analysis, Chemisorption technique, Thermal analysis, Spectroscopic techniques, Microscopic technique.

UNIT II KINETICS OF HETEROGENEOUS CATALYTIC REACTIONS **9**

Reaction mechanism and rate equations, Power law model, Langmuir-Hinshelwood –Hougen-Watson (LHHW) model, EleyRideal model, Rate controlling Step, Estimation of model parameters, Reactor types- Fixed bed reactor, Fluidised bed reactor, Berty Reactor, Multiphase Reactors- Slurry Reactor, Trickle bed reactor, Bioreactors, Catalysts tests.

UNIT III TRANSPORT PROCESSES WITH REACTIONS CATALYZED BY SOLIDS **9**

Effect of external transport on catalytic reaction rate, Effect of external mass transfer resistance on order of reaction, Effect of external transport on selectivity, Effect of internal mass transport on catalytic reaction rate, Bulk diffusion , Knudsen diffusion, Surface diffusion,Effectiveness factor at isothermal conditions, Significance of intrapellet diffusion, Effect of intrapellet mass transfer on activation energy

UNIT IV CATALYST DEACTIVATION 9

Types of Catalyst Deactivation. Kinetics of Catalyst Poisoning. Kinetics of Catalyst Deactivation by Coke Formation.

UNIT V INDUSTRIAL CATALYTIC PROCESSES 9

Steam reforming, Catalytic cracking, Three Lumped kinetic model for catalytic cracking of gas oil Hydrocracking, Hydrogenation and Dehydrogenation Catalytic Reactions

TOTAL: 45 PERIODS

OUTCOME:

- At the end of this course, the students would gain knowledge on the selection of catalyst and multiphase reactor for the heterogeneous reaction.

TEXT BOOKS:

1. Chemical Reactor Analysis and Design, Gilbert F. Froment and Kenneth B. Bischoff, John Wiley & Sons, 2nd Edition, 1990.
2. Elements of Chemical Reaction Engineering, H. Scott Fogler, Prentice Hall International Series, 3rd Edition, 2000.

REFERENCES:

1. Chemical Reaction Engineering, Octave Levenspiel, John Wiley & Sons, 3rd Edition, 1999.
2. Fundamentals of Chemical Reaction Engineering, Mark E. Davis and Robert J.Davis, McGrawHill, 2003.
3. An Introduction to Chemical Engineering Kinetics & Reactor Design, Charles G. Hill, Jr., JohnWiley& Sons, 1977.

PE8003 NUMERICAL RESERVOIR SIMULATION L T P C

3 0 0 3

OBJECTIVE:

- To enable the student to understand the basic concept and applications of Numerical Methods in Reservoirs.

UNIT I 9

Introduction, fracturing, Stress Distribution, Vertical Versus Horizontal Fractures, Pressure Related to Fracturing, Closure Pressure, Fracturing Pressure –Decline anlaysis, Pressure Interpretation After Closure, Properties of Fracturing Fluids.

UNIT II 9

Proppants, Propped Fracture Design, Fracture Propagation Model, Width Equations, Material Balance, Detailed Models. Evaluation of Fracture Design.

UNIT III 9

Acid Fracturing, Acid Systems and Placement Techniques, Fracturing of Deviated and Horizontal Wells, Matrix Stimulations, Matrix Acidizing Design, Rate and Pressure Limits for Matrix Treatment, Fluid Volume Requirements,

UNIT IV 9

Design and implementation of a multiphase flow reservoir simulator, including interphase mass transfer and variable fluid saturation pressure. Design of compositional reservoir simulators using generalized equation of state. Recent advances in reservoir simulation.

UNIT V **9**

Overview of simulator models and flow conditions. Methods of Solution. Performance Prediction. History match, concept on coning and compositional models. Stimulation Considerations.

TOTAL: 45 PERIODS

OUTCOME:

- Student will be able to understand the basics of Mathematics in Reservoir applications

TEXT BOOK:

1. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing.

REFERENCE:

1. Petroleum Exploration Hand Book by Moody, G.B.

GE8075 INTELLECTUAL PROPERTY RIGHTS **L T P C**
3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION **9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs **10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS **10**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW **9**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs **7**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL:45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, “Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.

REFERENCES

1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

PE8004 ONSHORE AND OFFSHORE ENGINEERING AND TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

To enable the students to

- Learn the concepts of petroleum site exploration, analysis of offshore structure
- Understand the offshore soil mechanics.

UNIT I **9**

Introduction to offshore oil and gas operations.. Sea States and Weather, Offshore Fixed and mobile Units, Offshore Drilling, Difference in drilling from land, from fixed platform, jack up, ships and semi submersibles. Offshore Well Completion, Offshore Production systems, Deep-water technology, Divers and Safety, Offshore Environment.

UNIT II **9**

Introduction; classification, properties of marine sediments. Consolidation and shear strength characteristics of marine sediments. Planning and site exploration.

UNIT III **9**

Drilling. Sampling techniques. Laboratory testing, In situ testing methods and geophysical methods. Current design practices of pile supported and gravity offshore structures**.**

UNIT IV **9**

Dynamic analysis of offshore structures. Centrifugal modeling. Anchor design. Break out resistance analysis and geotechnical aspects of offshore pipeline and cable design. Field instrumentation and performance observation.

UNIT V **9**

Offshore drilling systems and types of platforms; Ocean mining and energy systems. ROV. Onshore drilling-on shore oil rigs. onshore drilling equipments onshore rig structures-hydraulics applied in onshore rigs. construction methods of wet & dry completion.

TOTAL: 45 PERIODS

OUTCOME:

- Students will learn the basics of onshore and offshore oil and gas operations. They will learn the Laboratory testing methods, In situ testing methods and geophysical methods

TEXT BOOKS:

1. Standard Hand Book of Petroleum & Natural Gas Engineering” – 2nd Edition 2005-William C.Lyons & Gary Gulf-Gulf professional publishing comp (Elsevier).
2. Wellsite Geological Techniques for petroleum Exploration by Sahay.B et al.

REFERENCE:

1. Petroleum Exploration Hand Book by Moody, G.B.

PE8005 **PETROLEUM EQUIPMENT DESIGN** **L T P C**
3 0 0 3

OBJECTIVE:

- To study and analyze suitable equipment for particular reservoir conditions.

UNIT I **9**

Casing program, casing and tubing design, principles of cementing, completion added skin, well perforating, hydraulic fracturing. DRILL BIT DESIGN.ROLLER CONE BITS.PDC DRILL BITS.NOMENCLATURE AND IADC CODES for drill bits. BHA (Bottom hole assembly). ESP(Electrical submersible pumps). SRP(Sucker rod pumping) unit design.

UNIT II **9**

Design of Surface Facilities -Design of production and processing equipment, including deparation problems, treating, and transmission systems.

UNIT III **9**

Capstone design Student teams apply knowledge in the areas of geology, reservoir engineering, production, drilling and well completions to practical design problems based on real field data with all of the associated shortcomings and uncertainties. Use of commercial software.

UNIT IV **9**

Oil desalting-horizontal and spherical electrical dehydrators- Natural Gas Dehydration-Horton sphere- Natural Gas Sweetening. Crude & Condensate Stabilization-design of stabilizer- Oil and Gas Treatment. Treating Equipment**.**

UNIT V **9**

Refinery Equipment Design-atmospheric distillation column Design and construction of on/ offshore pipelines, Fields Problems in pipeline, Hydrates, scaling & wax etc and their mitigation..

TOTAL: 45 PERIODS

OUTCOME:

- Students will be able to understand the concept of designing Equipments for Petroleum Exploration

TEXT BOOKS:

1. Petroleum Exploration Hand Book by Moody, G.B.
2. Wellsite Geological Techniques for petroleum Exploration by Sahay.B et al

REFERENCE:

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

PE8073 **ENHANCED OIL RECOVERY** **L T P C**
3 0 0 3

OBJECTIVE:

- To impart knowledge on how residual oil is recovered and the problems associated with Enhanced Oil Recovery.

UNIT I FUNDAMENTALS OF ENHANCED OIL RECOVERY **9**

Pore Geometry, Microscopic aspects of displacement. Residual oil magnitude and mobilization. Buoyancy forces and prevention of trapping, Wettability, Residual oil and Oil recovery. Macroscopic aspect of displacement.

UNIT II WATER FLOODING 9

Properties, sampling and analysis of oil field water; Injection waters; Water flooding - Sweep efficiency, Predictive techniques, Improved water flood processes, Performance of some important water floods.

UNIT III ENHANCED OIL RECOVERY OPERATIONS - 1 9

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

UNIT IV ENHANCED OIL RECOVERY OPERATIONS - 2 9

Gas injection, in-situ combustion technology, microbial method.

UNIT V PROBLEMS IN ENHANCED OIL RECOVERY 9

Precipitation and deposition of Asphaltenes and Paraffin's, Scaling problems, Formation of damage due to migration of fines, Environmental factors.

TOTAL: 45 PERIODS

OUTCOME:

- Students would gain knowledge on residual oil recovery, operations and problems of Enhanced Oil Recovery.

REFERENCE:

1. Donaldson, E.C. and G. V. Chilingarian, T. F. Yen, "Enhanced oil Recovery – I & II", Fundamentals and Analysis, Elsevier Science Publishers, New York, 1985.
2. Lake, L.W., "Enhanced oil recovery", Prentice Hall, 1989.
3. Schumacher, M.M., "Enhanced oil recovery: Secondary and tertiary methods", Noyes Data Corp., 1978.
4. Van Poollen, H.K. "Fundamentals of enhanced oil recovery", PennWell Books, 1980.

GE8074 HUMAN RIGHTS L T P C

3 0 0 3

OBJECTIVE:

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I 9

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II 9

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III 9

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV 9

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V 9

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National

and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL: 45 PERIODS

OUTCOME:

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

PE8006 WATER FLOODING AND ENHANCED OIL RECOVERY L T P C
3 0 0 3

OBJECTIVE:

- To enable the students to understand the basics of oil recovery methods in oil & gas Industry.

UNIT I **9**

Introduction to Enhanced oil recovery methods – Schematic representation of enhanced oil Recovery – Techniques involved in EOR – Factors affecting EOR methods

UNIT II **9**

Chemical recovery methods – Polymer flooding – Surfactant flooding - Alkaline flooding – Hydrocarbon or Gas injection - Carbon dioxide (CO_2) flooding – Nitrogen and flue gas flooding - Thermal recovery methods – fire flooding – steam flooding

UNIT III **9**

Mechanism of surfactant/polymer flooding - Mechanism of alkaline flooding - Mechanism of hydrocarbon miscible flooding – Mechanism of CO_2 flooding - Mechanism of nitrogen and flue gas flooding – Mechanism of steam flooding.

UNIT IV **9**

Criteria for chemical methods - Criteria for gas injection - criteria for thermal methods. Microbial EOR methods (MEOR).

UNIT V **9**

Laboratory design for EOR – Preliminary test – Water analysis – Oil analysis – Core testing – Viscosity testing.

TOTAL: 45 PERIODS

OUTCOME:

- Students will be able to get the clear idea, better understanding and can get introduced with different types of recovery methods which are employed in the oil and gas Engineering.

TEXT BOOKS:

1. Von Pollen. H.K. and Associates. Inc., "Fundamentals of Enhanced oil Recovery" – Penn Well publishing co., Tulsa (1980)
2. Latil.M. et al., "Enhanced oil recovery" – Gulf publishing co. Houston (1980)

REFERENCE:

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

PE8093 PLANT SAFETY AND RISK ANALYSIS L T P C
3 0 0 3

OBJECTIVE:

- Become a skill and person in hazard and HAZOP analysis and able to find out the root cause of an accident. Gain knowledge in devising safety policy and procedures to be adopted to implement total safety in a plant

UNIT I INDUSTRIAL SAFETY 9

Concepts of safety – Hazard classification chemical, physical, mechanical, ergonomics, biological and noise hazards – Hazards from utilities like air, water, steam.

UNIT II HAZARD IDENTIFICATION AND CONTROL 9

HAZOP, job safety analysis – Fault tree analysis – Event tree analysis – Failure modes and effect analysis and relative ranking techniques – Safety audit – Plant inspection –Past accident analysis.

UNIT III RISK MANAGEMENT 9

Overall risk analysis – Chapains model, E and FI model– Methods for determining consequences effects: Effect of fire, Effect of explosion and toxic effect – Disaster management plan – Emergency planning – Onsite and offsite emergency planning –Risk management – Gas processing complex, refinery – First aids.

UNIT IV SAFETY PROCEDURES 9

Safety in plant design and layout – Safety provisions in the factory act 1948 – Indian explosive act 1884 – ESI act 1948 – Advantages of adopting safety laws.

UNIT V SAFETY IN HANDLING AND STORAGE OF CHEMICALS 9

Safety measures in handling and storage of chemicals – Fire chemistry and its control –Personnel protection – Safety color codes of chemicals.

TOTAL: 45 PERIODS

OUTCOME:

- At the end of this course, the students will be able to analyze the risk in the process industries.

TEXT BOOKS:

1. Blake, R.P., "Industrial Safety", third edition, Prentice Hall, 2000.
2. Lees, F.P., "Loss Prevention in Process Industries", Fourth Edition, Butterworth Heinemann, 2012.

REFERENCES:

1. Geoff Wells, "Hazard Identification and Risk Assessment", Institute of Chemical Engineers,1996
2. John Ridley and John Channing, "Safety at Work", 6th Edition. Butterworth Heinemann, 2003.
3. Raghavan, K.V. and Khan, A.A., "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.

PE8074 MULTICOMPONENT DISTILLATION L T P C
3 0 0 3

OBJECTIVE:

- To understand the concepts of Multicomponent distillation systems.

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 R_m 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

OUTCOME:

- Students able to design multicomponent distillation unit. They learn about various types of MCD column.

TEXT BOOKS:

1. Holland, C.D., “Fundamentals of Multi Component Distillation”, McGraw Hill Book Company, 1981
2. Van Winkle, “Distillation Operations”, McGraw Hill Publications, 1987.

REFERENCES:

1. King, C.J., “Separation Process Principles”, Mc Graw Publications, 1986.
2. Treybal, R.E., “Mass Ttransfer Operations”, 5th Edition, Mc Graw Hill publications. 1996.
3. Mc Cabe and Smith, J.C., Harriot, “Unit Operation of Chemical Engineering”, 6th Edition, McGraw Hill, 2001.

CH8076 PIPING AND INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on piping technology and instrumentation on pipelines.

UNIT I FUNDAMENTALS OF PIPING ENGINEERING 9

Definitions, Piping Components their introduction, applications. Piping MOC, Budget Codes and Standards, Fabrication and Installations of piping.

UNIT II PIPE HYDRAULICS AND SIZING 9

Pipe sizing based on velocity and pressure drop consideration cost, least annual cost approach, pipe drawing basics, development of piping general arrangement drawing, dimensions and drawing of piping.

UNIT III PLOT PLAN 9

Development of plot plan for different types of fluid storage, equipment layout, process piping layout, utility piping layout. Stress analysis -Different types of stresses and its impact on piping, methods of calculation, dynamic analysis, flexibility analysis.

UNIT IV PIPING SUPPORT 9

Different types of support based on requirement and its calculation.

UNIT V INSTRUMENTATION 9

Final Control Elements; measuring devices, instrumentation symbols introduction to process flow diagram (PFD) and piping & instrumentation diagram (P&ID)

TOTAL: 45 PERIODS

OUTCOME:

- Students gain knowledge on fundamentals of piping engineering, pipe hydraulics, piping supports and instrumentation.

TEXT BOOKS:

1. Piping Handbook, 6 th edition, M.L. Nayyar, P.E., Mc Graw-Hill, Inc
2. Piping Design Handbook edited by Johan J McKetta, CRC Press, 1992.
3. Luyben, W. L.," Process Modeling Simulation and Control for Chemical Engineers, McGraw Hill, 1990.

GE8077 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT II TQM PRINCIPLES 9

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward,

Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

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

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.

TOTAL: 45 PERIODS

OUTCOME:

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO9001-2015 standards

PE8007 PETROLEUM TRANSPORTATION AND DESIGN L T P C
3 0 0 3

OBJECTIVE:

- To enable the students to understand the fundamental concepts of transportation equipment and machinery design. To make student aware of different equipment and machineries used in petroleum industry.

UNIT I FUNDAMENTALS OF DESIGN 9

Steps in design activity. Selection of material. Theories of failure. Stress concentration and factor of safety. Creativity in design activity. Use of standards and codes in design activity. design of shaft, keys and coupling. .

UNIT II DESIGN OF MECHANICAL DRIVE COMPONENTS APPLIED TO PETROLEUM EQUIPMENTS 9

Design of belt drives. Types of pulleys, Design of pulleys (crown & travelling block) Wire ropesadvantages, construction, classification, factor of safety (wire rope sheaves drums), stresses in wire ropes. Classification of chains, power transmitting chains, power calculations. Design consideration for chain and gear drives, Bevel gears. (Rotary system). Power transmission on a rig.

UNIT III PUMPS & COMPRESSOR 9

Selection of pumps and valves. Specification of pumps, valves, performance curve, system pump interaction, two pumps in parallel & series (flow sheet) and compressors – reciprocating ,rotary, centrifugal, reciprocating cylinder sizing. Cooling & lubricating system. Introduction to hydraulic and pneumatic circuit and their components. Introduction to mud circulation system &equipments, Types of springs(compression helical – shale shaker) , Design consideration for pipeline used in oil and gas transportation.

UNIT IV DESIGN OF PRESSURE VESSEL 9

Design of shell. Design of head. Types of sealing materials and gaskets. Design of flanges. Design of nozzles. Classification and Design consideration of separators.

UNIT V DESIGN OF STORAGE SYSTEM 9

Storage of hydrocarbon fluids, Introduction to oil and gas storage facility. Types of storage tank and their design considerations. Design of fixed roof cylindrical storage tank. Liquids, liquefied gases, highly volatile HC, solids, and sulphur containing fluids.

TOTAL: 45 PERIODS

OUTCOME:

- Students would be able to understand the concepts of designing petroleum transportation equipments

TEXT BOOKS:

1. Arnold Ken and Stewart Maurice; Surface Production Operations volume -I, Design of Oil Handling Systems and Facilities; Gulf Publishing Company, Houston, Texas.
2. Bhandari V. B.; Design of Machine Elements; Tata McGraw Hill.
3. Joshi M. V.; Process Equipment Design; MacMillan.

REFERENCES:

1. Kennedy John N.; Oil and Gas Pipeline Fundamentals second edition; PennWell Publishing Company Tulsa, Oklahoma.
2. Khurmi R. S. and Gupta G. K.; A Text Book of Machine Design; Eurasia Publishing House (Pvt.) Ltd., 1994.

PE8075 PETROLEUM CORROSION TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To understand the types of corrosion found in the petroleum industries. This course will provide the student with knowledge of the analytical methods needed to diagnose, treat, and monitor corrosion to reduce costs, protect the environment, and increase safety.

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 equipments. 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

OUTCOME:

- Students will 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.

REFERENCE:

1. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing.

PE8008 WELL COMPLETION AND SIMULATION **L T P C**
3 0 0 3

OBJECTIVE:

- Students will learn the designing of well and its completion concepts. They will also learn the well simulation technologies.

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 (BHA) assembly. 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 Stimulation: Well completion design, types of completion, completion selection and design criteria. Interval selection and productivity Considerations: effects of producing mechanisms. Inflows performance and multiple tubing performance analyses using commercial software.

UNIT IV **9**

Well stimulation and work over planning. Tubing-packer m0ovement 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**

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

TOTAL: 45 PERIODS

OUTCOMES:

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

- Designing, well completion and to develop functional understanding of various equipment, processes and systems involved in drilling and completion operations
- Develop design capabilities for major engineering components and materials for safe operations and maximum production.

TEXT BOOKS:

1. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing.
2. Wellsite Geological Techniques for petroleum Exploration by Sahay.B et al.

REFERENCE:

1. Petroleum Exploration Hand Book by Moody, G.B.

PE8079	**STORAGE TRANSPORTATION OF CRUDE OIL AND NATURAL GAS**	**L T P C** **3 0 0 3**

OBJECTIVE:

- To understand the natural gas regasification technology, crude oil transportation and to learn the concepts of storage.

UNIT I INTRODUCTION **9**

Crude oil Trade, Selection of Port Location, Ship Building/Shipyards.

UNIT II NATURAL GAS REGASIFICATION TECHNOLOGY **9**

Commercial Sourcing of Natural Gas, Different Kinds of Regasification Techniques, Regasification Process & Cold Utilization, Synchronization of Degasified gas and Pipelines, Current Status in India

UNIT III CRUDE OIL TRANSPORTATION **9**

Transportation techniques of crude oil, Pipeline specification, Corrosion Prevention techniques, Pressure drop, Pumps and Booster station, Wax deposition and prevention, Chemical treatment

UNIT IV DESIGN **9**

Basic Engineering Aspects of Terminal Design, Design of Liquefaction Train, Ship Building/Shipyards, Storage Facilities

UNIT V CHARTERTICS OF STORAGE **9**

Supply & Demand, Variation Gas Field & Aquifers, Technical Qualities and Storage, Properties of Storage Reservoir, Rocks & Fluids. Flow through Storage Reservoir; Inventory Concept, Pressure- Content Hysteresis, Inventory Verification, Gas Flow Performance, Gas Deliverability.
Design & Development of Underground Storage Fields: Operation of Storage Fields. Threshold Pressure. Water Influx/Efflux Quantities. Aquifer Equilibrium Pressure. Error and Uncertainty.
Gas Storage in Salt Cavity & Caverns: Thermodynamics, Temperature and Pressure Effect. Recent Developments Advanced Storage Techniques, Case Histories.

TOTAL: 45 PERIODS

OUTCOME:

- Students would be able to design various terminal design. They will be familiarize with the storage systems.

TEXT BOOKS:

1. Oilfield Processing: Crude Oil (Oilfield Processing of Petroleum R. Solvay, Pennwell Books 1995.
2. Advances in Environmental Control Technology: Storage Tank Paul Cheremisinoff Gulf Professional Publishing; 1ST edition (May 9, 1996)

PE8078 RESERVOIR CHARACTERIZATION AND MODELING **L T P C**
3 0 0 3

OBJECTIVE:

- To enable the students to follow and utilize different concepts of reservoir modeling and characteristics and theirusage.

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 geostatitsics. 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

OUTCOME:

- Students gain the knowledge of reservoir characterization, modeling and simulation methods used in oil industry.

TEXT BOOKS:

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

REFERENCE:

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

PE8009 OIL FIELD EQUIPMENT DESIGN AND DRAWING L T P C
3 0 0 3

OBJECTIVE:

- To train the students in designing of the following equipments as per IADC, API, ISME, TEMA, ISI codes and drawing according to scale

LIST OF EXPERIMENTS

1. Drawing and design of Offshore platform TLP (TENSION LEG PLATFORM) - Fixed
2. platform design,
3. Drawing and design of offshore Jack ups
4. Drawing and design of well equipments]
5. Drawing and design of ROV (remotely operated vehicle)
6. Drawing and design of natural gas storage tank(Horton sphere)
7. Drawing and Designing of Mud tank
8. Drawing and design of on/offshore pipeline.
9. Drawing and design of rotary system in drilling

TOTAL: 45 PERIODS

OUTCOME:

- On completion of this practical course, the students would be able draw and design offshore jackups, pipeline well equipments, ROV, natural gas storage tank

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1. Intel Dual Core computer or better hardware with suitable graphics facility – 30 nos.
2. Licensed software for Drafting and Modeling – 30 Licenses.
3. Laser Printer or Plotter to print / Plot drawings – 2 Nos.

PE8077 PROCESS ECONOMICS L T P C
3 0 0 3

OBJECTIVE:

- The objective of this course is to teach principles of cost estimation, feasibility analysis, management, organization and quality control that will enable the students to perform as efficient managers.

UNIT I PRINCIPLES OF MANAGEMENT AND ORGANISATION 9

Planning, organization, staffing, coordination, directing, controlling, communicating, organization as a process and a structure; types of organizations. Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning; routing; scheduling; dispatching; costs and costs control, inventory and inventory control.

UNIT II INVESTMENT COSTS AND COST ESTIMATION 9

Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital, capital budgeting and project feasibility.

UNIT III PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENT 9

Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

UNIT IV ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE 9

Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.

UNIT V ECONOMIC BALANCE 9

Economic decisions in Chemical Plant – Economics of size – Essentials of economic balance – Economic balance approach, economic balance for insulation, evaporation, heat transfer.

TOTAL: 45 PERIODS

OUTCOME:

- At the end of this course, the students will have knowledge on cost and asset accounting, time value of money, profitability, alternative investments, minimum attractive rate of return, sensitivity and risk analysis.

TEXT BOOKS:

1. Peters, M. S. and Timmerhaus, C. D. RE West, “Plant Design and Economics for Chemical Engineers”, III Edn, McGraw Hill, 2003.
2. Holand, F.A., Watson, F.A. and Wilkinson, J.K., “Introduction to process Economics”, 2nd Edn, John Wiley, 1983.
3. Narang, G.B.S. and Kumar, V., “Production and Costing”, Khanna Publishers, 1995.
4. Banga T.R., and Sharma S.C., Industrial organization and engineering economics, Khanna Publishers, New Delhi.

REFERENCES:

1. Allen, L.A., “Management and Organization”, McGraw Hill.
2. Perry, R. H. and Green, D., “Chemical Engineer’s Handbook “, 8th Edition, McGraw Hill, 2007.

PE8076 PETROLEUM ECONOMICS L T P C

3 0 0 3

OBJECTIVE:

- To understand the basic quantitative theories and methodologist in oil sector.

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

OUTCOME:

- Students will be able to understand the concept and fundamentals of engineering economics of energy industry

TEXT BOOKS:

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

REFERENCES:

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

PE8010	**INTEGRATED OIL/GAS FIELD EVALUATION**	**L T P C**
		3 0 0 3

OBJECTIVE:

- To impart knowledge on different oil/gas field evaluations in order to maximize the production and improvement of facilities.

UNIT I **9**

Geological studies: – Structural contour maps and various geological models. Estimation of reserves. Hydrodynamic Study, Techno-economic Evaluation for normal and marginal fields. Innovative ways to asset development.

UNIT II **9**

Petroleum project evaluation-mineral project evaluation case studies. The design and evaluation of well drilling systems-Economic appraisal methods for oil field developmental project evaluation including risk analysis, probability and statistics in decision-making and evaluations. case studies.

UNIT III **9**

An integrated reservoir description in petroleum engineering-usage of geophysical, geological, petro physical and engineering data-emphasis on reservoir and well data analysis and interpretation, reservoir modeling (simulation), reservoir management (production optimization of oil and gas fields) and economic analysis (property evaluation)

UNIT IV **9**

An integrated reservoir development in petroleum engineering-reservoir and well evaluation production optimization-nodal analysis, stimulation, artificial lift facilities-surveillance.

UNIT V **9**

Evaluation of well completions-placement of casing, liners and well tubing. Evaluation, performance of horizontal wells. Evaluation of acidization treatments.

TOTAL: 45 PERIODS

OUTCOME:

- Students will be able to understand the different evaluation methods of oil/gas fields and reserves.

TEXT BOOKS:

1. Katz D.L.et al., Natural Gas Engineering (Production & storage), McGraw-Hill, Singapore.
2. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing.
3. Mc.Cray. A.W and Cole.F.W. 'Oil Well Drilling Technology' University of Oklahoma Press, Norman 1959.

GE8073 FUNDAMENTALS OF NANOSCIENCE **L T P C**
3 0 0 3

OBJECTIVE:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION **8**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION **9**

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling,

Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications-Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

TOTAL: 45 PERIODS

OUTCOMES:

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale Charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,“The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.