VELS

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI
NAAC ACCREDITED WITH 'A' GRADE
Marching Beyond 25 Years Successfully

B.Tech Petroleum Engineering

Curriculum and Syllabus

(Based on AICTE with
Choice Based Credit
System)
Effective from the Academic Year
2018-2019

Department of Petroleum Engineering
School of Ocean Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1: Build their career as a successful and distinguished Petroleum Engineer

PEO2: Pursue higher education and research in Oil and gas sector, other engineering streams and specializations

PEO3: Acquire innovative and creative thinking skills to augment their professional growth

PEO4: Nurture in design, analysis and implementation skills to innovation technology in Hydrocarbon sector with global context.

PEO5: Develop the awareness among the students about the various social responsibilities related to engineering ethics and human values with ecological importance.

PROGRAM OUTCOME

PO-1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO-2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO-6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOME

PSO-1: To learn various hydrocarbon exploration methods, hydrocarbon source and cap rock characterization techniques, field surveying and mapping the surface and sub-surface features to help finalize a pilot plan for exploration drilling.

PSO-2: To learn various types of drilling rigs including power systems, fluid circulation systems, well control systems, well monitoring systems, rotary systems, hoisting, drill string assemblies, cementation, directional drilling, and their economics for finalizing a drilling plan.

PSO-3: To learn various reservoir-well completions, methods of lifting hydrocarbon and other wellbore fluids to the surface by reservoir energy and/or artificial means, maintain efficient well production, stimulate reservoir, and design surface facilities required for oil and gas separation and preliminary processing and transportation.

PSO-4: To characterize and model conventional and unconventional hydrocarbon reservoirs to estimate both the reserves and the production potential under natural and improved recovery methods for optimum development of a field.

PSO5: Be able to build the nation, by imparting technological concepts and tools on emerging fields through the Managerial and entrepreneurs skills

BOARD OF STUDIES

The details of the suggested Board of Studies (BOS) Members for the Department of Petroleum Engineering are shown below.

S.No	Name of the Board Member	Designation	Institute / Industry
INTERNAL MEMBERS			
1	Mr. R.Soundara Pandian	Head of the Department, Petroleum Engineering	VISTAS
2	Dr. S. Pichaiah	Assistant Professor, Department of Petroleum Engineering	VISTAS
3	Mrs. Subhashini Sankar	Assistant Professor, Department of PetroleumEngineering	VISTAS
EXTERNAL EXPERT MEMBERS			
1	Mr.R.Ramakrishnan	General Manager(Retired), Head-BMG, Oil and Natural Gas Corporation Limited (ONGC), KG-PG Basin, Chennai	ONGC, Chennai
2	Dr.T.Nagalakshmi	Associate Professor, Department of Petroleum Engineering, AMET	AMET University, Chennai

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES

(VISTAS) B.Tech. PETROLEUM ENGINEERING DEGREE COURSE

COURSES OF STUDY AND SCHEME OF ASSESSMENT

(MINIMUM CREDITS TO BE EARNED: 170)

		Hours/Week				Maximum Marks		
Category	Course Title	Lecture	Tutorial	Practical	Credits	CA	SEE	Total
SEMESTER I								
18HSPE11	English	2	0	0	2	40	60	100
18BSPE12	Physics (Oscillation, Waves and Optics)	3	1	0	4	40	60	100
18BSPE13	Mathematics – I (Calculus and Linear Algebra)	3	1	0	4	40	60	100
18ESPE14	Basic Electrical Engineering	3	1	0	4	40	60	100
18ESPE15	Engineering Graphics & Design	1	0	4	3	40	60	100
18BSPE16	Physics Lab	0	0	3	1.5	40	60	100
18ELPE17	Electrical Engineering Lab	0	0	2	1	40	60	100
18HLPE18	English Lab	0	0	2	1	40	60	100
-		12	3	11	20.5			
SEMESTER II								
18BSPE21	Chemistry	3	1	0	4	40	60	100
18BSPE22	Mathematics – II (Probability and Statistics)	3	1	0	4	40	60	100
18ESPE23	Programming for Problem Solving	3	0	0	3	40	60	100
18BSPE24	Chemistry Lab	0	0	3	1.5	40	60	100
18ELPE25	Programming for Problem solving Lab	0	0	4	2	40	60	100
18ESPE26	Workshop/Manufacturing Practices	1	0	4	3	40	60	100
		10	2	11	17.5			

CA - Continuous Assessment
SEE - Semester End Examination

B.E. / B.Tech. DEGREE COURSE

COURSES OF STUDY AND SCHEME OF ASSESSMENT

Category	Course Title	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER III								
18BSPE31	Mathematics III	3	0	0	3	40	60	100
18PCPE32	Principles of Petroleum Engineering	3	0	0	3	40	60	100
18PCPE33	Petroleum Geology	3	0	0	3	40	60	100
18PCPE34	Petroleum Geophysics & Geochemistry	3	0	0	3	40	60	100
18PCPE35	Fluid Mechanics	3	0	0	3	40	60	100
18PCPE36	Electronics & Instrumentation	3	0	0	3	40	60	100
18PCPE37	Petroleum Geology Lab	0	0	3	1	40	60	100
18PCPE38	Fluid Mechanics Lab	0	0	3	1	40	60	100
18HSPE31	Personality Development I	2	0	0	2	40	60	100
18MCPE39	Health, Safety and Environmental Management in Petroleum Industries	2	0	0	2	40	60	100
		22	0	6	24			

Category	Course Title	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER IV								
18BSPE41	Mathematics IV	3	0	0	3	40	60	100
18PCPE42	Reservoir Engineering I	3	0	0	3	40	60	100
18PCPE43	Petroleum Thermodynamics	3	0	0	3	40	60	100
18PCPE44	Drilling Operations & Equipment's	3	0	0	3	40	60	100
18PCPE45	Drilling Fluids & Cement	3	1	0	4	40	60	100
18MCPE46	Environmental Science and Engineering	3	0	0	3	40	60	100
18HSPE41	Personality Development II	2	0	0	2	40	60	100
18PCPE47	Core Analysis Lab	0	0	3	1	40	60	100
18PCPE48	Drilling Fluids and cementing Lab	0	0	3	1	40	60	100
18BSPE49	Basic Life Skills	0	0	2	1	40	60	100
		20	1	8	24			

		Hours/Week				Maximum Marks		
Category	Course Title	Lecture	Tutorial	Practical	Credits	CA	SEE	Total
SEMESTER V								
18PCPE51	Reservoir Engineering II	3	1	0	4	40	60	100
18PCPE52	Production Equipment's & Operation	3	0	0	3	40	60	100
18PCPE53	Well Testing	3	0	0	3	40	60	100
18PCPE54	Hydrocarbon Processing & Plant Engineering	3	0	0	3	40	60	100
OEC	Open Elective – I	3	0	0	3	40	60	100
PEC	Professional Elective - I	3	0	0	3	40	60	100
18HSPE51	Personality Development III	2	0	0	2	40	60	100
18PCPE55	Petroleum Testing Lab	0	0	3	1	40	60	100
18PCPE56	Reservoir Engineering Lab	0	0	3	1	40	60	100
	Industrial Visit/NSS	0	0	0	0			
		20	1	6	23			

		Hours/Week				Maximum Marks		
Category	Course Title	Lecture	Tutorial	Practical	Credits	CA	SEE	Total
SEMESTER VI								
18PCPE61	Reservoir Modeling and Simulation	3	0	0	3	40	60	100
18PCPE62	Formation Evaluation & Well Logging	3	0	0	3	40	60	100
18PCPE63	Enhanced Oil Recovery & Water flooding	3	0	0	3	40	60	100
PEC	Professional Elective – II	3	0	0	3	40	60	100
PEC	Professional Elective – III	3	0	0	3	40	60	100
OEC	Open Elective – II	3	0	0	3	40	60	100
18HSPE61	Personality Development IV	2	0	0	2	40	60	100
18PCPE64	Heat & Mass Transfer Lab	0	0	3	1	40	60	100
18PCPE65	Standards of Training, Certification & Watch-keeping (STCW) Lab	0	0	3	1	40	60	100
18PRPE66	Summer Internship	0	0	2	1	40	60	100
		20	0	8	23			

		Hours/Week				Maximum Marks		
Category	Course Title	Lecture	Tutorial	Practical	Credits	CA	SEE	Total
SEMESTER VII								
PEC	Professional Elective– IV	3	0	0	3	40	60	100
PEC	Professional Elective – V	3	0	0	3	40	60	100
PEC	Professional Elective – VI	3	0	0	3	40	60	100
OEC	Open Elective – III	3	0	0	3	40	60	100
18PCPE71	AutoCAD	0	0	3	1	40	60	100
18HSPE72	Professional Ethics in Engineering	2	0	0	2	40	60	100
18PRPE73	Project Phase I	0	0	10	5	40	60	100
	Industrrial Visit	0	0	0	0			
		14	0	13	20			

		Hours/Week				Maximum Marks		
Category	Course Title	Lecture	Tutorial	Practical	Credits	CA	SEE	Total
SEMESTER VIII								
PEC	Professional Elective – VII	3	0	0	3	40	60	100
OEC	Open Elective – IV	3	0	0	3	40	60	100
OEC	Open Elective – V	3	0	0	3	40	60	100
18PRPE81	Project Phase II	0	0	16	8	40	60	100
		9	0	16	17			

B.Tech – PETROLEUM

ENGINEERING CURRICULUM

List of Professional Elective Courses

Code No.	Course	Hours / Week			Credits
		Lecture	**T**utorial	**P**ractical	**C**redits
18PEPE51	Petrochemicals & Petroleum Refining	3	0	0	3
18PEPE52	Natural Gas Engineering	3	0	0	3
18PEPE53	Reservoir Rocks & Fluids	3	0	0	3
18PEPE54	Pipeline Engineering	3	0	0	3
18PEPE61	Well Design & Completions	3	0	0	3
18PEPE62	Offshore Drilling & Production	3	0	0	3
18PEPE63	Elements of Reservoir Engineering	3	0	0	3
18PEPE71	Petroleum Economics	3	0	0	3
18PEPE72	Advanced Drilling Techniques	3	0	0	3
18PEPE73	Unconventional Hydrocarbon resources	3	0	0	3
18PEPE74	Production Chemicals & oil field chemistry	3	0	0	3
18PEPE75	Well Services & Stimulation Techniques	3	0	0	3
18PEPE76	Integrated Oil/Gas Field Evaluation	3	0	0	3
18PEPE77	Petroleum Equipment Design	3	0	0	3
18PEPE78	Surveying	3	0	0	3
18PEPE81	Reservoir Fluid Thermodynamics	3	0	0	3
18PEPE82	Petroleum Storage, Transportation & Marketing	3	0	0	3
18PEPE83	Elements of Reservoir Engineering	3	0	0	3
18PEPE84	Process Instrumentation Dynamics and Control	3	0	0	3
18PEPE85	Multi-component Distillation	3	0	0	3
18PEPE86	Well Control Methods	3	0	0	3

B.Tech – PETROLEUM ENGINEERING CURRICULUM

List of Open Elective Courses

Code No.	Course	Hours / Week			Credits
		Lecture	**T**utorial	**P**ractical	
18OEPE51	Statistics and Linear Programming	3	0	0	3
18OEPE52	Professional Ethics	3	0	0	3
18OEPE61	Energy Technology	3	0	0	3
18OEPE62	Equilibrium Staged Operations	3	0	0	3
18OEPE71	Supply Chain Management	3	0	0	3
18OEPE81	Total Quality Management	3	0	0	3
18OEPE82	Energy Audit And Energy Conservation Methods	3	0	0	3

List of Humanities and Social Sciences Elective Courses

Code No.	Course	Hours / Week			Credits
		Lecture	**T**utorial	**P**ractical	
18HSPE31	PERSONALITY DEVELOPMENT I	2	0	0	2
18HSPE41	PERSONALITY DEVELOPMENT II	2	0	0	2
18HSPE51	PERSONALITY DEVELOPMENT III	2	0	0	2
18HSPE61	PERSONALITY DEVELOPMENT IV	2	0	0	2
18HSPE11	NSS I	2	0	0	2

List of Basic Science Courses

Code No.	**Course**	**Hours / Week**			**Credits**
		Lecture	**Tutorial**	**Practical**	
18BSPE12	Physics (Oscillation, Waves and Optics)	3	1	0	4
18BSPE13	Mathematics – I (Calculus and Linear Algebra)	3	1	0	4
18BSPE16	Physics Lab	0	0	3	1.5
18BSPE21	Chemistry	3	1	0	4
18BSPE22	Mathematics – II (Probability and Statistics)	3	1	0	4
18BSPE24	Chemistry Lab	0	0	3	1.5
18BSPE31	Mathematics III	3	0	0	3
18BSPE41	Mathematics IV	3	0	0	3
18BSPE49	Basic Life Skills (Yoga)	0	0	2	1

List of Engineering Science Courses

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18ESPE14	Basic Electrical Engineering	3	1	0	4
18ESPE15	Engineering Graphics and Design	1	0	4	3
18ELPE17	Electrical Engineering Lab	0	0	2	1
18ESPE23	Programming for Problem Solving	3	0	0	3
18ELPE25	Programming for Problem Solving Lab	0	0	4	2
18ESPE26	Workshop/ Manufacturing Process	1	0	4	3

List of Employment Enhancement Course

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18PRPE66	Summer Internship	0	0	2	1
18PRPE73	Project Phase I	0	0	10	5
18PRPE81	Project Phase II	0	0	16	8

ACRONYMS

Code	Abbreviation
L	Summer Internship
T	Project Phase I
P	Project Phase II
C	Credits
CA	Continuous Assessment
SEE	Semester End Examination
PEC	Professional Elective Course
OEC	Open Elective Course
HSC	Humanities Science Course
BSC	Basic Science Course
ESC	Engineering Science Course
EEC	Employment Enhancement Course
MC	Mandatory Course

SYLLABUS
CORE COURSES

18HSPE11 ENGLISH 2 0 0 2

Course Objective:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

- To acquire ability to speak effectively in real life situations.
- To write letters and reports effectively in formal and business situations.
- To develop listening skills for academic and professional purposes.
- To gain effective speaking and listening skills in communication.
- To develop the soft skills and interpersonal skills to excel in their career.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment procedures.

Unit I Vocabulary Building **6**

General Vocabulary – Nouns - Compound nouns, Word borrowing & Word making, Foreign machinery in English, Dictionary and Thesaurus usages, Synonyms , Antonyms, Prefixes and Suffixes, Homonyms, Homographs and Homophones, Changing words from one form to another, Acronyms and Abbreviations.

Unit II Basic Writing **6**

Sentences structures – Kinds of sentences, Types of sentences, Clauses and Phrases, Punctuations, Word Links and Connectives, Summarizing, Precise writing, Paragraph Writing.

Unit III Identifying Common Errors in English **6**

Articles, Prepositions, Subject-verb Agreement, Pronouns - Relative pronouns, Demonstrative pronouns, Misplaced Modifiers, Redundancies, Clichés, Infinitives& Gerund

Unit IV Nature and Style of Sensible Writing **6**

Describing people, place and situations, Process description, Definitions, Numerical Expressions, Information Transfer- Flow chart Bar chart and Pie chart, Checklists, Writing introduction and conclusion.

Unit V Writing Practices **6**

Letter Writing- Formal & Informal Letters, Report Writing- Letter Report, Accident Report, Investigation Report and Survey, Essay writing, Comprehension Passages.

Total hours: 30

Course Outcome:

CO-1: List out a wide range of technical vocabulary to interpret the professional texts with attention to ambiguity, complexity, and aesthetic value.

CO-2: Infer implied meanings of different genres of texts and critically analyze and evaluate them for ideas as well as for method of presentations.

CO-3: Assess and write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.

CO-4: Infer meanings of different flowcharts and bar charts and develop constructive paragraphs deriving possible information to be obtained from them.
CO-5: Prepare letters to officials and to the Editor in formal and officials contexts

Text Books:

1. English for Scientists, Prof.K.R.Lakshminarayanan, Former Head, Department of Humanities and Social sciences, Sri Venkateshwara College of Engineering, Pennalur, Sriperumbudur, Tamilnadu SCITECH PUBLICATIONS (INDIA PVT.LTD)2014
2. Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
3. Department of Humanities and Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
4. Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
5. Department of Humanities and Social Sciences, Anna University, ''English for Engineers and Technologists'' Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
6. M.AshrafRizvi, "Effective Technical Communication", Tata McGraw-Hill Publishing Company Limited, New Delhi.2009

Suggested Readings:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

18BSPE12 **PHYSICS** **3 1 0 4**

(Oscillations, waves and optics)

UNIT I: Simple harmonic motion, damped and forced simple harmonic oscillator **9**

Harmonic oscillator – Differential equation and solution of simple harmonic oscillator – simple pendulum – damped harmonic oscillator: Equation of motion and its solution, qualitative description of heavy, critical and light damping – energy decay in a damped harmonic oscillator – Q factor – forced mechanical and electrical oscillators – power absorbed by oscillator.

UNIT II: Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion **9**

Waves, travailing waves example of waves, characteristics of a waves - longitudinal and transverse waves– Examples - Transverse wave on a string, the wave equation on a string- longitudinal waves and the wave equation- acoustics waves and speed of sound- characteristics of musical sound, quality of tone, decibel- noise pollution- acoustics- of buildings - Reverberation - Reverberation time.

UNIT III: The propagation of light and geometric optics **9**

Fermat's principle of stationary time- laws of reflection and refraction- Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection - Dispersion, Dispersive power of prism- Defect of lenses- spherical aberration- coma-achromatic lenses.

UNIT IV: Wave optics **9**

Huygens' Principle, superposition of waves - Young's double slit experiment- Newton's rings-Michelson interferometer, Mach Zehnder interferometer - Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision - Dispersion of a diffraction of grating and their resolving power.

UNIT V: Lasers **9**

Einstein's theory of matter radiation interaction and A and B coefficients- population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine

Total hours: 45

Course Outcome:

CO-1: Understand the basic concepts of simple harmonic oscillator.
CO-2: Identify the remedies for acoustic of building
CO-3: Illustrate the different types of aberration in lens.
CO-4: Distinguish between Fresnel and Fraunhofer diffraction
CO-5: Classify the different types of lasers and their applications.

Reference Books

1. Ian G. Main, Oscillations and waves in physics
2. H.J. Pain, The physics of vibrations and waves
3. E. Hecht, Optics
4. A. Ghatak, Optics
5. O. Svelto, Principles of Lasers

18BSPE13 **MATHEMATICS- I** **3 1 0 4**

(Calculus and Linear Algebra)

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Unit I: Calculus **12**

Evolutes and involutes-Evaluation of definite and improper integrals- Beta and Gamma functions and their properties

Unit II: Calculus
12

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders-indeterminate forms and L'Hospital's rule.

Unit III: Sequences and Series **12**

Convergence of sequence and series, tests for convergence- Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

Unit IV: Multivariable Calculus (Differentiation) **12**

Limit, continuity and partial derivatives, directional derivatives, total derivative- Tangent plane and normal line- Maxima, minima and saddle points- Method of Lagrange multipliers.

Unit V: Matrices **12**

Introduction to matrix and rank of a matrix-System of linear equations- Symmetric, skew-symmetric and orthogonal matrices-Eigenvalues and eigenvectors- Diagonalization of matrices-Cayley-Hamilton Theorem and Orthogonal transformation.

Course Outcome:

CO1: To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.

CO2: To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

CO3: To develop the tool of power series for learning advanced Engineering Mathematics.

CO4: To familiarize the student with functions of several variables that is essential in most branches of engineering.

CO5: To develop the essential tool of matrices in engineering.

Text Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11 ,Reprint, 2010

Reference Books:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008..
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

18ESPE14 BASIC ELECTRICAL ENGINEERING 3 1 0 4

Course Objective:

1. To obtain basic knowledge on electrical quantities such as current, voltage, power and energy.
2. To provide adequate working knowledge on basic DC and AC circuits used in electrical and electronic devices.
3. To understand the working principle, construction, applications of DC machines, AC machines & measuring instruments.
4. To emphasize the importance of transformers in transmission and distribution of electric power.

Unit I: DC Circuits **12**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, Mesh and Nodal analysis, Analysis of simple circuits with dc excitation, Wye↔Delta Transformation, Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Unit II: AC Circuits **12**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Unit III: Transformers **12**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Unit IV: Electrical Machines & Power Converters **12**

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Single phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. DC-DC buck and boost converters, duty ratio control. Single phase Bridge Rectifier, Single Phase voltage source inverters.

Unit IV: Electrical Installations **12**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Total hours: 60

Course Outcome:

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

- **CO-1:** Predict the behavior of any electrical and magnetic circuits. Formulate and solve complex AC, Dc circuits.
- **CO-2:** Identify the type of electrical machine used for that particular application.
- **CO-3:** Realize the requirement of transformers in transmission and distribution of electric power and other applications.
- **CO-4:** Understand the construction ,principle of operation, speed control of three phase induction motor
- **CO-5:** Demonstrate wiring, earthing and to do power factor calculations.

Text / References Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

18ESPE15 ENGINEERING GRAPHICS AND DESIGN 1 0 4 3

Course 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) 12

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: Introduction to Engineering Drawing and Plane Curves 12

Curves used in engineering practices: Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid, Epicycloid, Hypocycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves. Scales – Plain, Diagonal and Vernier Scales.

Unit II: Projection of Points, Lines and Plane Surfaces 12

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes - Auxiliary Planes

Unit III: Projection of Solids 12

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method - Auxiliary Views

Unit IV: Section of Solids and Development of Surfaces 12

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section - Auxiliary Views. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

Unit V: Orthographic Projection and Isometric Projection 12

Free hand sketching: Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement - layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects. Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

Total Hours: 60

Course Outcome:

CO-1: Develop special curves and sketch by free hand orthographic views

CO-2: Understand and draw the projections of points, straight lines and planes

CO-3: Sketch the projections of simple solids like prisms, pyramids, cylinder and cone

CO-4: Develop lateral surfaces of the uncut and cut solids

CO-5: Develop the perspective projection of simple solids, truncated prisms, pyramids, cone and cylinders and sketch the isometric projection.

Text Books:

1. N.D. Bhatt, "Engineering Drawing" Charotar Publishing House, 46 th Edition, (2003).

References:

1. K.V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2006).
2. M.S. Kumar, "Engineering Graphics", D.D. Publications, (2007).
3. K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited (2008).
4. M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education (2005).
5. K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications (1998).
6. Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited (2008).
7. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, (2008).

18BSPE16 **PHYSICS LAB** **0 0 3 1.5**

List of Experiments

1. Spectrometer –Dispersive Power of prism
2. Spectrometer – Grating
3. Semiconductor Laser – To find Wavelength and particle size.
4. Ultrasonic Interferometer
5. Torsional Pendulum
6. Hooke's Law
7. Compound pendulum- To determine 'g'
8. Newtons' Ring
9. Air wedge
10. Bifilar Pendulum

Course Outcome:

CO-1: Examine the dispersive power of the prism using spectrometer.
CO-2: Estimate the formation of Newton's rings in the air-film in between a plano-convex lens.
CO-3: Calculate the wavelength and particle size of semiconductor diode laser.
CO-4: Measure the velocity of ultrasonic waves and compressibility of the liquid using ultrasonic interferometer.
CO-5: Calculate the gravity g at that place and the radius of gyration

18ELPE17 ELECTRICAL ENGINEERING LAB 0 0 2 1

Course Objective:

1. To provide comprehensive idea about AC and D C circuit analysis, working principles and applications of basic machines in electrical engineering.

List of Laboratory Experiments/Demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi- meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification.
3. Resonance in R-L-C circuits.
4. Loading of a transformer: measurement of primary and secondary voltages and currents, and power
5. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line -
6. Load Characteristics of a DC Motor
7. Torque - Slip Characteristic of an Induction motor
8. Three phase induction motors - Direction reversal by change of phase-sequence of connections.
9. Demonstration of dc-dc converter.
10. Demonstration of dc-ac converter.
11. Demonstration of ac-dc converter.

Total hours: 30

Course Outcome:

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

CO1: Study different meters and instruments for measurement of electrical quantities

CO2: Measure power and power factor in ac circuits

CO3: Understand 3 phase balanced and unbalanced, star and delta connected supply with load and to

CO4: Measure power in 3 phase circuits

CO5: Understand the Characteristics of DC motor and Induction motor

18HLPE18 **ENGLISH LAB** **0 0 2 1**

Course Objectives:

- To gain effective speaking and listening skills in communication.
- To develop the soft skills and interpersonal skills to excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises

List of Exercises:

- Listening comprehensions
- Pronunciation, Phonology
- Intonation
- Stress and Rhythm
- Situational Dialogues
- Communication in workplace
- Interviews, Seminar
- Formal Presentations
- Group Discussions
- Debates
- JAM sessions

Total hours: 30

Course Outcome:

CO-1: Use appropriate communication strategies for enhancing interpersonal relationship

CO-2: Apply soft skills in personal, social and corporate life

CO-3: Articulate knowledge of chosen profession and corporate skills effectively in interviews with appropriate body language

CO-4: Demonstrate active group discussion and presentation skills such as initiating a conversation, exchanging ideas, expressing dissent or agreement and giving persuasive presentation.

CO-5: Prepare job applications, various letters, abstract and summary for technical articles.

Text Books:

1. English for Scientists, Prof.K.R.Lakshminarayanan, Former Head, Department of Humanities and Social sciences, Sri Venkateshwara College of Engineering, Pennalur, Sriperumbudur, Tamilnadu SCITECH PUBLICATIONS (INDIA PVT.LTD)2014
2. Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
3. Department of Humanities and Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
4. Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.

5. Department of Humanities and Social Sciences, Anna University, ‘‘English for Engineers and Technologists’’ Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
6. M.AshrafRizvi, “Effective Technical Communication”, Tata McGraw-Hill Publishing Company Limited, New Delhi.2009

Suggested Readings:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

18BSPE21 CHEMISTRY 3 1 0 4

Course Objective

The course will enable the student to

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Unit I : Atomic and molecular structure, Intermolecular forces and potential energy surfaces 14

Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN.

UNIT II: Spectroscopic techniques and application 12

Principles of spectroscopy and selection rules. Electronic spectroscopy. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Diffraction and scattering

UNIT III: Use of free energy in chemical equilibria 12

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

UNIT IV: Periodic properties 12

Variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

UNIT V: Organic reactions and synthesis of a drug molecule 10

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Total hours: 60

Course Outcome:

CO-1: To explain the relation between the intermolecular forces present within a substance and the temperatures associated with changes in its physical state.

CO-2: To apply formalisms based on molecular symmetry to predict spectroscopic properties.

CO-3: To determine and understand the operation of electrochemical systems for the production of electric energy, i.e. batteries and fuel cells.

CO-4: To explain general corrosion in terms of electrochemistry

CO-5: To explain the arrangement of elements in the periodic table and relate the arrangement to electronic configuration, bonding and properties.

Text Books

1. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane.
2. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
3. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.

Reference Books

1. Physical Chemistry, by P. W. Atkins. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5^{th} Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp.
2. University chemistry, by B. H. Mahan.

18BSPE22 **MATHEMATICS-II** **3 1 0 4**

(Probability and Statistics)

Course Outcome:

The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

Unit I: Basic Probability **12**

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Unit II: Continuous Probability Distributions **12**

Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities.

Unit III: Bivariate Distributions **12**

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Unit IV: Basic Statistics **12**

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

Unit V: Applied Statistics **12**

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Course Outcome:

CO-1: The students will have a fundamental knowledge of the concepts of probability.
CO-2: Knowledge of standard distributions which can describe real life phenomenon.
CO-3: The notion of sampling distributions and statistical techniques used in engineering
CO-4: Use appropriate statistical methods in the analysis of simple datasets
CO-5: Develop skills in presenting quantitative data using appropriate diagrams, tabulations and summaries

Text/Reference Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

18ESPE23 PROGRAMMING FOR PROBLEM SOLVING 3 0 0 3

Course Objective:

- To understand the basic concepts of programming – Flow chart, Pseudo code.
- To learn the fundamentals of C programming - declarations, operators, expressions and control statements.
- To learn the manipulation of strings, functions, pointers and file operations.
- To understand the concepts of arrays, basic sorting and searching algorithms**.**
- To find the order of time complexity of basic algorithms

Unit 1: Introduction to Programming 9

Introduction to Programming (Flow chart / pseudo code, compilation etc.), Variables (including data types) -Arithmetic expressions and precedence, Conditional Branching and Loops - Writing and evaluation of conditionals and consequent branching Iteration and loops

Unit 2: Arrays and Basic Algorithms 9

Arrays (1-D, 2-D), Character arrays and Strings, Searching, Basic Sorting Algorithms, Finding roots of equations, Notion of order of time complexity through example programs

Unit 3: Function and Pointers 9

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion with example programs such as Finding Factorial, Fibonacci series, etc. Pointers - Defining pointers, Use of Pointers in self-referential structures

Unit 4: Structures and Unions 9

Structures - Defining structures and Array of Structures, Structures containing Pointers, Unions - Storage classes: auto, static, extern, register – Dynamic memory allocation

Unit 5: String Functions and Files 9

Strings - library string functions, pointers in strings, pointers and function arguments, Files - file Operations, processing a file, Preprocessor directives, use of type def, Command line arguments, Enumerated data types.

Total Hours: 45

Course Outcome:

CO-1 Understand the principles of algorithm, flowchart and pseudo code.
CO-2 Find the order of time complexity of algorithms.
CO-3 Understand programs involving control instructions, arrays, structures and unions.
CO-4 Utilize the string manipulations, and to write functions for various applications using C programming constructs.
CO-5 Apply the file operations in ‘C’ programming.

Text Books:

1. Byron Gottfried, “Schaum's Outline of Programming with C”, McGraw-Hill

2. E. Balaguruswamy, “Programming in ANSI C”, Tata McGraw-Hill 3.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, Prentice Hall of India
2. Yashavant Kanetkar, “Let Us C”, BPB Publications
3. Ashok.N.Kamthane, “Computer Programming”, Pearson Education (India)

18BSPE24 **CHEMISTRY LAB** **0 0 3 1.5**

Course Objective:

The aim of this lab is to illustrate the principles of chemistry relevant to the study of science and engineering by doing experiments.

List of experiments

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

Course Outcome

The students will able:

CO-1: To estimate the rate constants of reactions, freezing point depression and partial coefficient of immiscible liquids.
CO-2: To develop a small drug molecule and analyse a salt sample.
CO-3: To find the viscosity and partition coefficient of a substance.
CO-4: To determine the saponification value of an oil.
CO-5: To determination of cell constant and conductance of solutions

Text Books

1. S. Sundaram and K. Raghavan “Practical Chemistry”, S. Viswanathan. Co. 3rd edition **2011**.
2. Gnanaprakasam, Ramamurthy, “Organic Chemistry Lab Manual” S. Viswanathan Pvt. Ltd. 3rd edition 2011

Reference Books

1. Vogel's – "Textbook of qualitative organic Analysis", Longmann, 12th edition, **2011**
2. J. N. Gurtu and R. Kapoor "Advanced experimental Chemistry", S. Chand and Co. 6th edition, **2010**

18ELPE25 PROGRAMMING FOR PROBLEM SOLVING LAB 0 0 4 2

Course Objective:
To design and develop C Programs for various applications

List of Experiments:

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems
5. 1D Array manipulation
6. Matrix problems
7. String operations
8. Simple functions
9. Solving Numerical methods problems
10. Recursive functions
11. Pointers and structures
12. File operations

Course Outcome
The students will able:

CO1 : Understand the Programming Environment
CO2 : Develop programs using various control instructions and operator precedence in C Programming.
CO3 : Apply the string manipulations, arrays and functions for various applications in C.
CO4 : Analyze the use of structures, unions and pointers in C
CO5 : Utilize the various file operations in C

18ESPE26 WORKSHOP/MANUFACTURING PRACTICES 1 0 4 3

Course Objective:

- To study bench fitting drawings for making male and female fittings as per the given dimensions and Tolerances.
- To study Arc welding drawings for making common weld joints as per the given dimensions.
- To study sheet metal development drawings for making common metal parts/components as per the given dimensions.

Workshop Practice:

- **Machine shop**
  To make Facing and plain turning, step turning, drilling in the lathe
- **Fitting shop**
  To make square, V joint in bench fitting as per the given
  dimension And Tolerances
- **Carpentry**
  To make half lap joint, dovetail, TEE Lap joint
- **Welding shop**

  To make single, butt, lap and T fillet joint by arc welding with the back hand and fore hand welding techniques as per the given dimensions.
- **Sheet Metal Work**
  To make simple Dust pan, Rectangular trays in sheet metal with the jigs as per the given Dimensions.

Course Outcomes:

After successful completion of the Engineering Practices Laboratory course, the student will be able to

CO-1: Able to make various joints in the given object with the available work material.

CO-2: Familiarity with different types of woods used and tools used in wood Working technology.

CO-3: Familiarity with different types of tools used in sheet metal working.

CO-4: Developments of sheet metal jobs from GI sheets, knowledge of basic concepts of soldering.

CO-5: Familiarity with different types of tools used in fitting tec

18BSPE31 **Mathematics – III** **3 0 0 3**

(Fourier Series and Transforms)

Course Objective:

To understand Fourier series representation of periodic signals. The analysis of signal is far more convenient in the frequency domain.

UNIT I: FOURIER SERIES **12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.

UNIT II: FOURIER TRANSFORM **12**

Fourier integral theorem (without proof) – Fourier transform pair – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III: PARTIAL DIFFERENTIAL EQUATIONS **12**

Formation of partial differential equations - singular integrals- Solutions of standard types of first order partial differential equations – Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous functions.

UNIT IV: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12**

Classification PDE-Method of separation of variables – One dimensional wave and heat equation – Steady state solution of two-dimensional heat equation (square plate only) .

UNIT V: Z -TRANSFORM AND DIFFERENCE EQUATIONS **12**

Z-transform –Introduction- properties – Inverse Z-transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z- transform.

Total Hours: 60

Course Outcome:

CO1: Develop Fourier series for different types of functions.
CO2: Define and determine Fourier Transform.
CO3: Derive and obtain the solution of wave, heat equation
CO4: Problems of Fourier series and Fourier transforms used in engineering applications.
CO5: Students understand the z-transforms and its properties

TEXTBOOKS:

1. Grewal. B.S, "Higher Engineering Mathematics", Khanna Publications ,Delhi,43rd Edition, 2013.
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 6th reprint,2008.
3. SivaramakrishnaDas.P&Vijayakumari.C , A Text book of Engineering Mathematics-III

REFERENCE BOOKS:

1. Bali.N.P. and Manish Goyal 'A Textbook of Engineering Mathematics', Laxmi Publications, 9th edition,2011.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 9th Edition, 2011.
3. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education ,3rd Edition, 2012.
4 . Transforms and partial differential eaquations- A.Singravelu

18PCPE32 Principles of Petroleum Engineering 3 0 0 3

Course Objectives: To impart basic knowledge about the various facts of Petroleum Engineering, Structure of petroleum compounds, Drilling, Formation Evaluation, Well Testing and Well site operations - Also to understand the basic Principles of Petroleum Engineering**.**

Unit I: Introduction **9**

Chemistry of petroleum - Structure of petroleum compounds, Types – alkanes, Napthenes, paraffins, aromatics. Physical and chemical properties of formation fluids, petroleum economics.

Unit II: Drilling **9**

Drilling – History, types of drilling –cable tool, rotary, drilling rigs and components. Drilling fluids, casing and cementation.Types of wells – exploratory, delineation, development wells. Vertical, deviated, inclined, horizontal and ERD wells - Planning – GTO.

Unit III: Logs **9**

Formation Evaluation – cutting, cores, mud logging unit, well logging, types of well logs and their use. Basic relationships of well log interpretation, the spontaneous potential (SP) log, gamma ray and caliper log, resistivity log, porosity and lithology determination.

Unit IV: Well testing and production **9**

Well Testing, perforation, testing methods, well completion production. Stimulation methods, recovery methods, Material balance, reserves estimation, drilling fluid control, data acquisition during drilling.

Unit V: Environmental concerns **9**

Introduction to environmental control in the petroleum industry, environmental transport of petroleum wastes, well site operations, roles of drilling, reservoir and production, hazards, environmental concerns, transportation of oil and gas, oil pollution and control.

Total hours: 45

COURSE OUTCOME:

CO-1: To be well versed with the fundamental principles of petroleum engineering stream and Industry as well.
CO-2: To be aware of the physical and chemical properties of reservoir oil, gas, and formation water.
CO-3: To clearly understand the basic concepts in oil and gas drilling.
CO-4: To have basic knowledge about different types of wells.
CO-5: To be well versed with formation evaluation and well logging.

TEXT BOOKS

1. T.E.W Nind, Principles of oil production - 2nd edition Mc Graw-Hill, 1981.
2. A.T. Bourgoyne, K.K. Millheim, M.E. Chenevert and F.S. Young Jr.Applied, Drilling Engineering (Digital Edition -Rental), SPE Textbook Series Vol. 2, 1991.
3. Carl Gatlin; Petroleum Engineering: Drilling and Well Completions, Prentice Hall, Technology and Engineering, 1960.

REFERENCE BOOKS

1. A.G. Lucas, Modern Petroleum Technology Upstream, Vol I Hurley Publishing, Edition 2002.
2. A.G. Lucas, Modern Petroleum Technology Downstream, Vol II Hurley Publishing, VI Edition 2002.
3. Introduction to Petroleum Engineering by Geltin.
4. J.CH Garry, Hardward G.E and M.J.Kaiser, Petroleum Refining: Technology and economics, CRC Press ,V Edition,2007

18PCPE33 Petroleum Geology 3 0 0 3

Course Objectives: To impart sound knowledge on nature and properties of rocks and minerals, their sedimentation pattern, sedimentary basins and geological methods in search of hydrocarbons and well site geological methods.

UNIT I: Introduction **9**

Age and origin of earth, interior of earth, plate tectonics, and geologic times scale. Sedimentary geology, Basins and Margins. Properties of subsurface fluids. Petroleum Chemistry.

UNIT II: Rocks **9**

Types of rocks and their formation, texture, minerals and properties, clay minerals, Sedimentary rocks – classification of rocks, types of sedimentary rocks, properties, sedimentation process, sedimentary environments.

UNIT III: Geomorphology **9**

Geomorphology – concepts, processes, Stratigraphy – principles, order of superposition, palaeontology and index fossils. Structural geology – principles, folds, faults, joints and unconformities; Geology of India.

UNIT IV: Origin of Petroleum **9**

Origin and distribution of petroleum – Sedimentary basins – types, origin and classifications, petroleum system – Generation, Migration, Accumulations of hydrocarbons. Description of some Indian petroliferous basin.

UNIT V: Testing and Analysis **9**

Well site geological methods – sample collection & description, fluorescence, cores & core analysis, correlation and introduction to various geological maps, stratigraphic methods.

Total hours: 45

COURSE OUTCOME:

CO-1: To understand the basic concepts of petroleum geology**.**
CO-2: To clearly understand the geological basin and hydrocarbon reservoir.
CO-3: To clearly explain the different rock types and properties.
CO-4: To be well versed with the sedimentary basins, stratigraphy and sedimentation process.
CO-5: To have a basic knowledge about geomorphology and palaeontology.

TEXT BOOKS

1. Cox, P.A., “The Elements on Earth”, Oxford University Press, Oxford 1995.
2. Wilson, M., Igneous Petrogenesis”, Unwin Hyman, London 1989.
3. G B Mahapatra, A Text book of Geology, CBS Publication, New Delhi.

REFERENCE BOOKS

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

18PCPE34 Petroleum Geophysics & Geochemistry 3 0 0 3

Course Objectives: To impart knowledge on the concepts of geophysics and geochemistry for petroleum exploration, geophysical methods – gravity, magnetic, seismic, data acquisition, processing and interpretation, 2D, 3D, 4D seismic and geochemical evaluation methods.

UNIT I: Introduction to geophysics **9**

Geoscience disciplines, Geo engineering concept, Introduction to geophysics, geophysical methods of exploration, physical properties of rocks-density, susceptibility, resistivity, elasticity, factors controlling the properties.

UNIT II: Gravity and Magnetic methods **9**

Gravity and Magnetic methods – Gravity method –definition, gravity surveying, measurement methods, anomalies data interpretation.Magnetic methods – concepts, survey and measurements, anomalies, interpretation.

UNIT III: Seismic methods **9**

Fundamentals of elasticity, Bulk Modulus, Poisson's ratio, elastic seismic wave theory, body and surface waves, P&S waves, seismic instruments, seismic channels, application of seismic data, interpretation of data and maps.

UNIT IV: Hydrocarbons **9**

Composition and characteristics of liquid and gaseous petroleum hydrocarbons-normal, branched and is alkanes, aromatics, asphaletene, resins. Hydrocarbon impurities, oil field waters – definitions and characteristics.

UNIT V: Survey **9**

Surface and subsurface geochemical surveys, Role of geochemistry in petroleum exploration, organic matter and kerogen – characteristics and types. Maturation, measurement of maturity-thermal alteration index, vitrinite reflectances. Rock Eval, Hydrogen index, gas chromatography.

Total hours: 45

COURSE OUTCOME:

CO-1: To understand the basic concepts in geophysics.
CO-2: To be well versed with different geophysical oil and gas exploration methods.
CO-3: To be aware of gravity and magnetic methods.
CO-4: To clearly understand the principles of surveying, anomalies, and interpretation.
CO-5: To acquire the fundamental knowledge about the working process of Seismic method.

TEXTBOOKS

1. Mason, B. and Moore, C.B., "Introduction to Geochemistry", Wiley Eastern, 1991.
2. Faure, G., 1986, Principles of isotope Geology, John Wiley, 2002.

REFERENCE BOOKS

1. The Blue Planet : An introduction to Earth System Science 2nd Edition by Brain

J.Skinner, 2005.
2. Hoefs, J., “Stable Isotope Geochemistry”., Springer Verlag, 1980.
3. Krauskopf, K.B., “Introduction to geochemistry”, McGraw Hill, 1967.

18PCPE35 **Fluid Mechanics** **3 0 0 3**

Course Objectives: To develop student's ability to understand fundamentals of fluid mechanics, fluid motion, equation of motion, Newton's law of fluid friction, laminar and turbulent flow, various types of pump, friction coefficient, continuity equation etc.

UNIT-I: Introduction to Fluid Mechanics **9**

Concept of fluid- fluid as a continuum – physical properties- density, specific weight, specific volume & specific gravity, problems- thermodynamic properties- isothermal process, adiabatic process, dimension of R, universal gas constant, problems- pressure-viscosity-types of fluid-surface tension-capillarity-vapour pressure & cavitation-problems.

UNIT-II: Fluid Statics **9**

Fluid pressure-Pascal's law-pressure variation in a fluid at rest –measurement of pressure: manometers-simple & differential manometer-pressure at a point in compressible fluid-temperature at any point in compressible fluid-problems- hydrostatic forces on a submerged surfaces: vertical, horizontal, inclined & curved –problems- buoyancy & flotation.

UNIT-III: Fluid Kinematics, Fluid Dynamics **9**

Classifications of fluid flow-acceleration in fluid flow-streamlines, path lines & streak lines- examples –equation of continuity & its application - Equation of motion, Bernoulli's equation, Navier stokes equation of motion – problems.

UNIT-IV: Flow Measurement, Transmission Of Energy **9**

Venturi, Orifice, nozzles, mouth pieces-pitot tube & sharp crested weirs/notches – steady flow through pipes- Darcy Weisbach equation-losses in pipelines-Hydraulic & energy gradient;

Uniform in open channels-Chezy's equation - Fanning's equation-Economical rectangular cross section- Trapezoidal cross sections.

UNIT-V: Compressible Fluids, Dimensional Analysis & Similitude **9**

Isothermal adiabatic flow- continuity & energy equations-steady flow of gases through venturi meter & pipes. Introduction – dimensions of physical quantities- dimensional homogeneity-dimensional groups; Buckingham π theorem –group method- Rayleigh's method of indices- dimensionless numbers- applications of dimensional method-similitude-problems

Total hours: 45

COURSE OUTCOME:

CO-1: To acquire the fundamental knowledge and concepts of fluid mechanics.
CO-2: To be aware of basic thermodynamic properties.
CO-3: To understand the behavior of fluid at rest.
CO-4: To understand the impacts of hydrostatic forces on fluid flow in a particular medium.
CO-5: To clearly differentiate the concepts of fluid kinematics and dynamics.

TEXT BOOKS

1. Neol de Nevers, "Fluid Mechanics for Chemical Engineers." Second Edition, Tata Mc.Graw Hill-1991.
2. James O.Wilkes and Stacy G.Bikes, "Fluid Mechanics for chemical Engineers" Prentice Hall PTR (International Series in Chemical Engineering) – 1999.

3. Mc.CabeW.L.Smith, J.C and Harriot, P “Unit operations in Chemical Engineering”, Mc.Graw Hill, V Edition, 2001.

REFERENCE BOOKS

1. James O.Wilkes and Stacy G.Bikes, “Fluid Mechanics for Chemical Engineers”, 3rd edition, 2001.
2. White F.M., “Fluid Mechanics”, IV Edition, Mc.Graw – Hill Inc. 1999.
3. Darby, R. “Chemical Engineering Fluid Mechanics” Marcel Decker, 1998.

18PCPE36 Electronics & Instrumentation 3 0 0 3

Course Objectives: To impart Knowledge on Various instrument systems and their errors, various signal conditioning circuits. To understand the Principle of various active and passive transducers, various storage and display devices, Instruments for measuring the various electrical and electronics quantities.

UNIT-I Semiconductor Basics 9

Introduction to semiconductors – Intrinsic and Extrinsic – Doping – P and N type semiconductors – charge carriers – valence and conduction bands.P-N Junction:PN junction diode – barrier potential – forward and reverse bias – diode specifications – diode as a rectifying element – half wave, full wave and bridge rectifier – filter circuits – ripple filtering – capacitor, inductor and combination filters.

UNIT-II Zener Diode 9

Breakdown voltage – avalanche and zener breakdowns – operation under forward and reverse bias – zener diode as a voltage regulator. Bipolar Junction Transistor:PNP and NPN types – construction – working principles – transistor as a switch and as amplifier – series and shunt voltage regulators – transistor configurations – CB, CE and CC.

UNIT-III Special Semiconductor Devices 9

Light Emitting Diode, Liquid Crystal Display, 7segment displays – Diode for Alternating Current (DIAC) - Triode for Alternating Currents (TRIAC) – Device characteristics, Input output characteristics- their applications.

UNIT-IV Digital Electronics 9

Basic gates and derived logic gates – simplified implementation –conversions between analog signals and digital signals, transfer characteristic of DAC, digital to analog conversion techniques, performance parameters of DAC.

UNIT-V Transducers 9

Primary and secondary – active and passive – analog and digital transducers – pressure, temperature, speed, displacement and light sensors – open loop and closed; loop configurations.

Total hours: 45

COURSE OUTCOME:

CO-1: To understand the basic concepts of semiconductor**.**
CO-2: To be aware of diode components and filter methods.
CO-3: To clearly understand the Zener diode functions.
CO-4: To be well versed with the working process of bipolar junction transistor.
CO-5: To have the knowledge and awareness about special semiconductor devices.

TEXTBOOKS

1. Morris, A.S ," Principle of Measurement and Instrumentation ", Prentice Hall of India

,1999.
2. Doebelin E.O., "Measurement Systems - Application and Design ",Tata McGraw Hill Publishing Company-1990

REFERENCE BOOKS

1. Murthy , D.V.S., " Transducer and Instrumentation ", Prentice Hall of India Pvt. Ltd. , 1995.
2. Millman J. and Halkias .C., " Integrated Electronics ", 4 Edition,TataMcGraw Hill Publishing Company-2001

18PCPE37 **Petroleum Geology Lab** **0 0 3 1**

Course Objectives: To determine experimentally the Preparation of terrain and Plotting of geological data on terrain map. Also to identify the structure of contour maps. Preparation of porosity and saturation map and reserves can be estimated in the Laboratory.

List of Experiments

1. Preparation of terrain profile map.
2. Plotting of geological data on terrain map.
3. Preparation of subsurface geological section.
4. Lithological correlations.
5. Preparation of structure contour maps.
6. Preparation of porosity and saturation map.
7. Estimation of reserves.

Total hours: 40

COURSE OUTCOME:

CO-1: Students develop the ability to recognize mineral properties and use those to differentiate and identify common rock forming minerals.

CO-2: Students acquire the skills to classify igneous rocks using texture and composition as identified in hand samples.

CO-3: Working with sedimentary rocks students demonstrate their ability to differentiate clastic versus chemical sedimentary rocks; are able to identify the respective rock types and provide a reasonable environment of deposition.

CO-4: Students apply their mineral identification skills and knowledge of degrees of foliation to identify metamorphic rocks.

CO-5: Students will demonstrate an understanding of topographic maps, rules of contours, and the common coordinate systems in use including the public land survey system.

18PCPE38 **Fluid Mechanics Lab** **0 0 3 1**

Course Objectives: To determine experimentally the flow characteristics of fluids and also to determine the efficiency of the flow measuring devices and fluid transport machineries. To give the exposure of all the fluid mechanics equipments and also to visualize the fundamental concept of fluid mechanics.

List of Experiments

1. Determination of co-efficient of discharge by using Orifice Meter both by experimentally and graphically.
2. Determination of co-efficient of discharge by using Venturi Meter both by experimentally and graphically.
3. Study the performance of a reciprocating pump and to determine the characteristics with maximum efficiency by using Reciprocating Pump.
4. Verify Bernoulli's Theorem Apparatus.
5. Determination of kinematic viscosity and absolute viscosity of lube oil at different temperature by using Redwood Viscometer.
6. Identify the type of flow (Laminar, Transition and Turbulent) by using Reynolds apparatus.
7. Calculation of friction factor by using Darcy Weisbach Equation theoretically.

Total hours: 40

COURSE OUTCOME:

CO-1: Identify, name, and characterize flow patterns and regimes.
CO-2: Understand basic units of measurement, convert units, and appreciate their magnitudes.
CO-3: Utilize basic measurement techniques of fluid mechanics.
CO-4: Discuss the differences among measurement techniques their relevance and applications.
CO-5: Measure fluid pressure and relate it to flow velocity.

18MCPE39 Health, Safety and Environmental Management in Petroleum Industries 2 0 0 2

Course Objectives: The course will give an overview of the safety and environmental issues in the petroleum industry. It will provide detailed understanding of the methods and techniques to resolve these key issues for making petroleum production and processing, cleaner and safer. This course would educate the students to identify and assess hazards in any stage of operation, to quantify and manage them as well.

UNIT I: Introduction to pollution 9

Pollution – air pollution, water pollution, land pollution, noise pollution, Hazards – natural and man-made. Hazards materials used in oil industry, Environmental impact and its consequences, Acts related to pollution.

UNIT II: Risk Assessment & Management 9

Waste discharge in on shore and offshore operations, their impact on environment, toxicity, heavy metals, chemicals, drilling fluids, produced water, radioactive elements cuttings and fluid disposal methods, effluent treatment, gas flaring.

UNIT III: Safety assurance and assessment 9

Lost circulation zones, differential stuck up, sticky clay, well deviation, high pressure zones, blow-outs, Safety measures. Gas hydrates-high pressure, very low temperatures, drilling hazards.

UNIT IV: Environmental issues and management 9

Oil Storage methods at drill site, ground water contamination, well abandonment methods and cite restoration, oil spill and leak, remedial measures. Offshore facilities, - hazards and environmental problems.

UNIT V: Safety measures in design and operation 9

General, obligations of the owner, operator or Contractor, Safety measures during drilling, logging, production & transportation regulatory procedures and mines act Environment Impact Assessment report case studies.

Total hours: 45

COURSE OUTCOME:

CO-1: To provide a basic concepts of pollution and types of pollution
CO-2: To provide a detailed study on hazards and its environmental impact
CO-3: To emphasize the impacts on environment from the waste discharged from oil and gas industry
CO-4: To emphasize the various solid waste disposal methods and effluent treatment methods.
CO-5: To impart knowledge about the safety measures involved in it.

TEXT BOOKS

1. Boesch D.F and Rabalis Nancy, “Long term environmental effects of offshore oil and

gas Developments", 7th edition, 2003.
2. "Environmental control in Petroleum Engineering" by Reis J.C, Gulf publications, 5th edition,1968

REFERENCE BOOKS

1. Katz D.L. "Natural Gas Engineering (Production &storage)",TataMcGraw-Hill, Singapore, 6th edition, 2007.
2. SmithJ.M, " Chemical Engineering Kinetics", McGrawHill, 3rd edition, 1981.
3. Blake,R.P,"Industrial VSafety", PrenticeHall,3rd edition, 1953

18BSPE41 **Mathematics IV** **3 0 0 3**
(Numerical Methods)

Course Objective:
Using appropriate numerical methods, determine approximate solutions to ordinary differential equations. Analyze the errors obtained in the numerical solution of problems.

UNIT I: Solution Of Equations And Eigen value Problems **12**
Solution of algebraic and transcendental equations –iteration method – Newton Raphson method – Solution of linear system of equations- Gauss elimination method –- Gauss-Jordon method–Matrix Inversion by Gauss Jordon method – Eigen value of a matrix by power method.

UNIT II: Interpolation And Approximation **12**
Interpolation with unequal intervals- Lagrange's interpolation – Newton's Divided difference interpolation– Interpolation with equal intervals- Newton's forward and backward difference formulae.

UNIT III: Numerical Differentiation And Integration **12**
Approximation of derivatives using interpolation polynomials- Numerical integration using trapezoidal and Simpson's 1/3 and 3/8 rule – Romberg's method

UNIT IV: Initial Value Problems for Ordinary Differential Equations **12**
Single step methods: Taylor series method – Euler's method-Modified Euler's method– Fourth order Runge – Kutta method for solving first order equations

UNIT V: Boundary Value Problems In Ordinary and Partial Differential Equation -12
Finite difference methods for solving two-point linear boundary value problems – Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain

Total Hours: 60

Course Outcome:
CO-1: To apply appropriate algorithms to solve selected problems, both manually and by writing computer programs.
CO-2: To compare different algorithms with respect to accuracy and efficiency of solution.
CO-3: To appropriate numerical methods, determine the solutions to given non-linear equations.
CO-4: Using appropriate numerical methods, determine approximate solutions to systems of linear equations.
CO-5: To demonstrate the use of interpolation methods to find intermediate values in given graphical and/or tabulated data.

TEXT BOOKS:
1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science ", 9th Edition, Khanna Publishers, New Delhi, 2012.
2. Gerald, C. F. and Wheatley, P.O., "Applied Numerical Analysis", 6th Edition, Pearson Education, Asia, New Delhi, 2006.
3. Sivaramakrishna Das.P and Vijayakumari.C, Numerical Analysis, 2014, Pearson Eduaction Limited in south Asia.

REFERENCE BOOKS:

1. Chapra, S. C and Canale, R. P., “Numerical Methods for Engineers”,Tata McGraw-Hill, New Delhi, 5th Edition, 2007.
2. Sankara Rao K, “Numerical Methods for Scientisits and Engineers”, Printice Hall of India, New Delhi, 3rd Edition,2007 .

18PCPE42 Reservoir Engineering I 3 0 0 3

Course Objectives: To introduce the basic concept of Reservoir Engineering, estimation of hydrocarbon volume in place and recovery calculations. Students will be able to gain knowledge of Petroleum Reservoir, fundamentals of petro-physics, interrelation between petro-physical parameters capillary gravity equilibrium and initial fluid distribution.

UNIT I Introduction **9**

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, wettabiity and contact angle, effective permeability characteristics, capillary pressure curves – Resistivity factors and saturation exponents. Fluid PVT analysis and oil gas phase behavior.

UNIT II Reservoirs **9**

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 Fluid in reservoirs **9**

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 Residual oil **9**

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

UNIT V Well analysis **9**

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

Total hours: 45

COURSE OUTCOME:

CO-1: To understand the fundamental concepts in reservoir engineering
CO-2: To clearly understand the mass balance concepts and equations
CO-3: To understand the reservoir pressure maintenance and various recovery

mechanisms..

CO-4: To be well aware with permeability variation and Darcy laws of fluid flow in porous medium.

CO-5: To be aware of well inflow equations and constant terminal solutions

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. – Applied Petroleum Reservoir Engineering" 2nd Edition. Prentice Hall Englewood Cliffs, N.J., 1991

REFERENCE BOOKS

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).

18PCPE43 Petroleum Thermodynamics 3 0 0 3

Course Objectives: To impart knowledge on principles of thermodynamics and will be able to apply this knowledge to new situation. To calculate the parameters such as specific heats, vapour pressure and compressibility factor and Calculate the heat of reaction, heat of formation, etc. and will be able to draw the P- T, T-X-Y diagrams for single and multi-component systems.

UNIT I: Introduction 9

Behaviour of Gases and Liquids – Gas laws, Density, Mole percent, Weight percent, Volume percent, Specific gravity, Heat, work closed and Open Systems, First and Second Laws of thermodynamics, specific heats, compressibility factor, PVT relationships, Vapour Pressure, Claussius - Clayperson equation, heat of vaporization.

UNIT II: Chemical Thermodynamics of Petroleum Hydrocarbons 9

Free energy, change, heat of reaction, Entropy change, Heat capacity, Heat of formation, fugacity, Pressure – volume diagram, Density – Temperature diagram for one and two component system. Pressure – Composition diagram, Temperature – Composition diagram, temperature – Composition diagram for multi component system Gibbs phase rule.

UNIT III: Qualitative phase behaviour of Hydrocarbon systems 9

Calculation of liquid and vapour composition of Bubble point and Dew point pressure for multi component system, Equilibrium constant. Phase Definitions and the Gibbs Phase Rule, Equilibrium of H_2O and Hydrocarbon Systems without Hydrates, Equilibrium of H_2O and Hydrocarbon Systems with Hydrates

UNIT IV: Hydrocarbon Fluid Characteristics 9

Gas information volume factor, Gas solubility, Oil formation volume factor, Viscosity., Types of Gas Reservoirs: Characterizations by phase diagrams- Gas properties calculations Dry gas properties- Wet gas and condensate gas (above DP) properties (recombination calculations) Condensate gas properties below DP

UNIT V: Properties of mixtures 9

Dalton Law Volumetric analysis of a gas mixture – apparent weight and gas constant – specific of a mixture – determination of calorific values of fuels – oil and fuel vapour mixtures – steam condenser.

Total Hours: 45

COURSE OUTCOME:

CO-1: Calculate the parameters such as specific heats, vapour pressure and compressibility factor
CO-2: Calculate the heat of reaction, heat of formation, etc. and will be able to sketch the P-T, T-X-Y diagrams for single and multi-component systems
CO-3: Analyse the various parameters for a multi-component system and calculate the equilibrium constant
CO-4: Evaluate the hydrocarbon fluid characteristics such as gas formation volume factor
CO-5: Convert the given volumetric analysis into gravimetric analysis and vice versa; determine the specific heat of mixtures and functioning of a steam condenser.

TEXT BOOKS

1. Smith J.M., H.C. Van Ness, M.M. Abbott, "Introduction to chemical Engineering Thermodynamics", Tata Mc. Graw – Hill publishing company limited, New Delhi, sixth edition, 2005.

2. John J.Mcketta Jr. "Advances in Petroleum Chemistry and Refining" - volume 9 (inter science publications) New york, 1983.

REFERENCE BOOKS

1. Jean Vidal, Thermodynamics Application in Chemical Engineering and the petroleum industry, Institute Francalsbupetrole publications, France 2003.
2. Stanley.I.Sandler, chemical and Engineering Thermodynamics' Willey, 1988.

18PCPE44 Drilling Operations & Equipments 3 0 0 3

Course Objectives: The Main aim is to understand the Well Drilling Equipments. The objective of learning this subject is the students will understand the Drilling Process and Drilling operations, Drilling Equipments**,** Hydraulics and Kill Procedures.

UNIT I Drilling 9

Drilling operations – Location to Rig. Release Well Bore Diagram, Crews – Operator – Drilling, contractor – Third Party Services – Rig Types – Land Types – Marine types, Main offshore fields, Challenges, Effects on environment

UNIT II Components 9

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

UNIT III Planning 9

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

UNIT IV Hydraulics 9

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 Shut down 9

Origin of Overpressure, Kick Signs, shut – in Procedures- Drilling—land or bottom-supported offshore rig and Tripping—land or bottom-supported offshore rig,Kill sheets, Kill Procedures, Driller's Methods – Engineer's Method (Wait and Weight)

Total Hours: 45

COURSE OUTCOME

CO-1: To get an introduction about drilling operation and equipments.
CO-2: To be well versed with various components for oil and gas drilling.
CO-3: To understand the well planning procedures..
CO-4: To understand the hydraulic systems in drilling rig.
CO-5: To be aware of well shut-down and killing procedures.

TEXT BOOKS

1. Devereux, S., "Drilling Technology", PennWell Publishing Company, 1999.
2. Azar, J.J. and G. Rabello Samuel, "Drilling Engineering", PennWell Corporation, 1937.

3. Devereux, S, “Practical Well Planning and Drilling”, PennWell Corporation, 1998.

REFERENCE BOOKS

1. Standard Handbook of “Petroluem and Natural Gas Engineering”, 2nd Edition, William C Lyons, Gary C Pilisga, Gulf Professional Publishing.
2. Rabia.H., “Oil Well Drilling Engineering, Principles And Practices’ Graham And Trotman Ltd. 1985
3. Donald P.Helander ‘Fundamentals Of Formation Evaluation’, OGCI Publications, 1983

18PCPE45 Drilling Fluids & Cement 3 1 0 4

Course Objectives : The main aim is to understand the fundamentals of drilling fluids and cementing technology. The objective is that students will be able to understand the different types of drilling fluids used in the drilling process and different stages of cementing techniques.

UNIT I Introduction 12

Introduction - basic functions and properties of drilling fluids and cement slurries. Compositions and related properties of drilling fluids and cement slurries, Portland cement-general, cement chemical nomenclature and other abbreviations

UNIT II Drilling fluids 12

Drilling fluid – Classification of drilling fluids, functions of drilling fluids, composition of drilling fluids, properties of drilling fluids - Drilling fluid additives. Selection factors for drilling fluid and mud handling equipment.

UNIT III Cements 12

Composition of Portland cement, Cement Testing, and Standardisation of drilling Cements, Types of equipment and methods used in cementing operations. Composition of different forms of cements and cement additives.

UNIT IV Cementing Procedures 12

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

UNIT V Analysis 12

Determination of torque and drag. Calculation of cutting transport efficiency. Gas migration through cement columns. Thermal Cements – Geothermal Well cementing. Cement Job design. Calcium hydroxide content in cement,

Total hours: 60

COURSE OUTCOME:

CO-1: Student will understand the basic function of drilling fluids and cementation.
CO-2: Student get a deep knowledge about the different types of drilling fluid.
CO-3: Student will understand the cement and additives of it.
CO-4: Student will obtain a deep knowledge of cementing techniques.
CO-5: Student obtains knowledge about the parameters plays a role in cementing operation.

TEXT BOOKS

1. Rabia.H. 'Oil Well Drilling Engineering, Principles And Practices' Graham And Trotman Ltd. 1985.
2. Applied Drilling Engineering, Adam T Bourgyne *et al* SPE 1986.
3. Cementing' SPE Publications 2nd Edition 1976.
4. Cementing Technology – Powel Schlumberger Publication 1984.
5. Well Cementing, E. B. Nelson Vol 28, Schlumberger Publication 2006.

REFERENCE BOOKS

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.

18MCPE46 Environmental Science and Engineering 3 0 0 3

Course Objectives: To develop the students' understanding in environmental related issues such as environmental, air, water and soil pollution**,** need for public awareness**,** natural resources and biodiversity**,** Renewable and non-renewable resources, threats to biodiversity, etc.

UNIT I Environmental awareness 9

Environmental awareness: Multidisciplinary nature of environmental Science, Definition, Scope, Importance and need for public awareness. Ecology and Environment: Concept of an ecosystem, structure and function of an ecosystem, producer consumer and decomposer, energy and nutrient flow biogeochemical cycles, food chain, food web, ecological pyramid.

UNIT II Environmental Pollution 9

Environmental Pollution: Segments of environment, sources, pathways and face of environmental pollutants, causes of environmental pollution - physical, chemical and biological transformation of pollutants, population explosion, environment and human health, human rights, value education, women and child welfare.

UNIT III Air Pollution 9

Air Pollution: Various segments of atmosphere and their significance, classification of air pollutants, toxic effects, sampling and analysis, stationary and mobile emission, sources and their control, photochemical smog, sulphurous smog, green house effect, global warming, ozone depletion, Air (prevention and control of pollution) Act.

UNIT IV Water pollution 9

Water pollution: Water resources, sources of water pollution, various pollutants, their toxic effect, portability of water, municipal water supply, disinfection, characteristics of waste, primary and secondary waste water treatment, BOD and COD measurement and their significance, rain water harvesting, water shed management, Water (pollution and control) Act.

UNIT V Natural Resources and Biodiversity 9

Natural Resources and Biodiversity: Renewable and renewable resources, Forest resources, consequences of deforestation, floods and draughts, equitable use of resources for sustainable development. Dams benefits and problems. Biodiversity: Ecosytsem diversity, threats to biodiversity, conservation of biodiversity. A brief introduction to Noise Pollution, Soil Pollution, solid Waste Management.

Total hours: 45

COURSE OUTCOME:

CO-1: Student will understand the nature and facts about environment.

CO-2: Student obtains the knowledge about the interrelationship between living

organisms and environment.

CO-3: Students will get a deep knowledge about the cause and control measures of the air pollution

CO-4: Students will get a deep knowledge about the cause and control measures of the water pollution.

CO-5: Student obtains a knowledge about the various resources and biodiversity.

TEXT BOOK

1. Dr. V. Balasubramaniam, Dr. Sreedevi, Dr. G. Ramachandran, Environmental Science, CARS Publishers, West mambalam, Chennai-33

REFERENCE BOOKS

1. De AK. Environmental Chemistry, Wiley Eastern Ltd.
2. Miller T.G. Environmental Science, Wadsworth Publishing Co. (TE) Sharma B.K.2001, Environmental Chemistry, Gael Publishing House, Meerut Odem

18PCPE47 **Core Analysis Lab** **0 0 3 1**

Course Objectives: In the core analysis lab the students will learn experimentally the properties of rocks, Identification of Minerals, Porosity Determination, determination of Permeability, Determination of Saturation etc.,

List of Experiments:

1. Identification of Minerals
2. Determination of Saturation, Dean-Stark distillation method
3. Measurement of fluid density using the pycnometer
4. Liquid viscosity measurement using capillary type viscometer
5. Porosity determination by liquid saturation method
6. Resistivity measurements of fluid-saturated rocks
7. Absolute permeability measurement of water
8. Contact angle measurement using imaging method
9. Capillary pressure measurement using centrifuge
10. Study of Rock Properties

Total hours: 40

COURSE OUTCOME

CO-1: To identify different minerals and rocks.
CO-2: To measure the physical properties of various fluids.

18PCPE48 Drilling Fluids & Cementing Lab 0 0 3 1

COURSE OBJECTIVE: The aim of this lab to provide hands on training of the equipment used in the field to know the behavior of the drilling fluids at various conditions.

List of Experiments

1. To prepare the WBM/OBM drilling fluids.
2. To determine the density of water based mud prepared.
3. To determine the viscosity of water based mud prepared.
4. To determine the hydrogen ion concentration of the water based mud prepared.
5. To determine the viscosity of oil based prepared.
6. To determine the resistivity of a drilling mud prepared
7. To determine the gel strength of the sample by penetrometer
8. To determine the density of cement slurry prepared.

Total Hours: 40

COURSE OUTCOME:

CO-1: Student can able to understand the physical properties of drilling mud at to be used at various conditions

CO-2: Student will obtain the knowledge about the behavior of mud.

CO-3: Student obtain the knowledge about the importance of the mud density

CO-4: Student get the knowledge about the importance of gel strength and pH of mud during drilling.

CO-5: Student will come to know the importance of viscosity of mud for lifting the rock cuttings.

18BSPE49 Basic Life Skills 0 0 2 1

COURSE OBJECTIVE: Providing value education to improve the students' character - understanding of principled life and physical health - maintaining youthfulness - measures and methods in five aspects of life

UNIT I Physical Health 6

1. Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment.
2. Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.
3. Yogasanas: Pranamasana - Hastha Uttanasana - Pada Hasthasana – AswaSanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana.
4. Pranayama : Naddi suddi - Clearance Practice - Benefits.

UNIT II Life Force 6

1. Reasons for Diseases - Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)
2. Philosophy of Kaya kalpa - Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind.
3. Maintaining youthfulness : Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid –
4. Measure and method in five aspects of life - Controlling undue Passion.
5. Kayakalpa practice - Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

UNIT III Mental Health 6

1. Mental Frequencies - Beta, Apha, Theta and Delta wave - Agna Meditation explanation - benefits.
2. Shanthi Meditation explanation - Benefits
3. Thuriya Meditation explanation - Benefits
4. Benefits of Blessing - Self blessing (Auto suggestion) - Family blessing - Blessing the others - World blessing - Divine protection

UNIT IV Values 6

- Human Values:
  1) Self control - Self confidence - Honesty
  2) Contentment - Humility - Modesty
  3) Tolerance - Adjustment - Sacrifice - Forgiveness
  4) Purity (Body, Dress, Environment) - Physical purity - Mental purity - Spiritual purity
- Social Values:
  1. Non violence - Service

2. Patriotism - Equality
3. Respect for parents and elders - care and protection - Respect for teacher
4. Punctuality - Time Management

UNIT V MORALITY (VIRTUES) **6**

1. Importance of Introspection - I - Mine (Ego, Possessiveness).
2. Six Evil Temperaments - Greed - Anger - Miserliness - Immoral sexual passion - Inferiority and superiority Complex – Vengeance.
3. Maneuvering of Six Temperaments - Contentment - Tolerance - Charity - Chastity - Equality - Pardon (Forgiveness).
4. Five essential Qualities acquired through Meditation: Perspicacity - Magnanimity - Receptivity - Adaptability – Creativity.
5. Improved Memory Power - Success in the Examination.

TOTAL: 30 Hours

COURSE OUTCOMES:

After successful completion of the Basic Life Skills course, the student will be able to

CO-1: Develop communication competence in prospective engineers.

CO-2: Explain the moral value of human's life and their psychological bag round.

CO-3: Instill moral and social values, loyalty and also to learn to appreciate the rights of others.

CO-4: Provide value education to improve the health by yoga etc.

CO-5: Understand the concept of negative and positive energies, measurement and method in five aspects of life.

REFERENCE BOOKS:

1. Vethathiri Maharishi, 16th Edi.2013, Yoga for Modern Age, Vethathiri Publications, Erode.
2. Vethathiri Maharishi, 2014, Simplified Physical Exercises, Vethathiri Publications, Erode.
3. Vethathiri Maharishi, 3rd Edi.2014, Kayakalpam, Vethathiri Publications, Erode.
4. Rev.Dr.G.U.pope, 2016, Thirukkural, Giri Trading Agency,
5. Vethathiri Maharishi, 1994, Mind, Vethathiri Publications, Erode.
6. Chandrasekaran.K, 1999, Sound Health through yoga, Sedapati, Tamilnadu, Premkalyan Publications.
7. Iyengar, B.K.S. 2008, Light on Yoga, Noida, UP India, Harber Collins Publishing India Ltd.

18PCPE51 Reservoir Engineering II 3 1 0 4

Course Objectives:

The aim of this subject is to understand and follow the reservoir concepts such as reservoir simulation, rock characteristics and reservoir management**.** The main objective is to provide a knowledge to interpret cross-plots, well characteristics, simulation and gas condensate reservoirs**.**

UNIT- Introduction 9

Fluid characteristics. Introduction to the production system. Characteristics of the reservoir rocks. Porosity, Permeability cross plots. Fluid saturation, capillary pressure, gas material balance- recovery factor.

UNIT - II Reservoir Flows 9

Multiphase flow: Relative permeability: fractional flow. Well performance – inflow performance, tubing performance. Derivation of the basic radial flow equation, conditions of solution.

UNIT – III Well Testing 9

Well testing – Basic well testing theory – oil well testing: gas well testing – Practical well testing – Gas field reservoir engineering – Fluid phase behavior – 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. Coning of water and gas; effects of partial penetration.

UNIT – IV Material balance techniques 9

Material balance techniques: Production forecasting – Gas condensate reservoir engineering Fluid phase behavior development – options. Reservoir drive mechanisms, solution gas drive, gascap drive.

UNIT – V Reservoir Simulation 9

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 drawdown and buildup analysis.

Total Hours: 45

Course Outcomes:

CO-1: Students can able topredict the performance of the reservoir by interpretation of cross plots and stimulation techniques.Students can able to know how do the production pattern changes based upon reservoir characteristics.

CO-2: Students will acquire the knowledge of flow behavior in the reservoir system.

CO-3: Students will get the knowledge about the performance of well based upon phases of fluid existing in the reservoir.They can able to get the knowledge of production potential of the reservoir through several tests.

CO-4: Students can able to provide an idea to maintain the production level to meet the demands.Students can able to provide a detailed report on amount of reserves in the formation and the amount of fluids which can be recoverable economically.

CO-5: By mathematicallyStudents can able to provide a detailed report on fluid flow behavior based upon the reservoir pressure.

Total Hours: 45

TEXT BOOKS

1. Ahmed,T,"ReservoirEngineeringHandbook",3rdEdition,Elsevier,2006.
2. Slip Slider, H.C. "World wide Practical Petroleum Reservoir Engineering Method, Penn Well Publishing Company,1983.
3. Amyx.J.W.etal."Petroleum reservoir engineering"–Mc.Graw-hill-1998.

REFERENCE BOOKS

1. Gianluigichierici,"PrinciplesofPetroleumReservoirEngineering",Elsevier,1994.
2. Archer.J.sandWallC.C."Petroleumengineeringprinciplesandpractice",kluwer1990.
3. CraftB.C .and Hawkins M. P. "Applied Petroleum reservoir engineering" 2-nd Edition Prentice hall –1991.

18PCPE52 Production Equipment's& Operation 3 0 0 3

Course Objectives:

The aim of this subject is to understand and follow the concepts of oil and gas production techniques. The student will be able practice both theory and practical of different production operations in the oil and gas wells such as artificial lifts and subsurface equipments.

UNIT I Components **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 Well Performance **9**

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

UNIT III Equipments

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 Measuring System **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. Water disposal, corrosion. Water injection systems. Sub-surface equipment**.**

UNIT V Analysis **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 hours: 45

Course Outcomes:

CO 1: Students can predict the productivity of the various state of the reservoir fluids.
CO 2: Students will understand the behavior performance of the well based upon various systems.
CO 3: Students can understand the surface facilities and the processing of the reservoir fluids.
CO 4: Students will get a deep knowledge of the treatment process and flow measurement

system.
CO 5: Students will obtain the knowledge about the performance of the well for various system.

TEXT BOOKS

1. S.Kumar,"GasProductionEngineering"GulfpublishingCo.,-1987.
2. T.E.W.Nind,"PrinciplesofwellProduction"-2nd Edition.Mc.GrawhillBook-Co.Ltd,Newyork1981.

REFERENCE BOOKS

1. T.O.allenandA.P.Roberts."Productionoperations"–SPE-Vol-I,4th edition,2006.
2. Guo, B, Lyons, W.C. and Ghalambor, A., "Petroleum production Engineering- A computer assisted approach", Gulf Professional Publishing, Burlington, 2nd edition,2009.

18PCPE53 **Well Testing** **3 0 0 3**

Course Objectives: This course is to provide a working knowledge of the current methodologies used in well testing and the concepts of porosity and permeability. Also to estimate oil, gas, and water properties pertinent for well test analysis using industry accepted correlations and/or laboratory data.

Unit I Introduction **9**

Role, History and uses of well test, Well test data acquisition, analysis, and management, Selection of wells for optimum stimulation treatment, Reservoir system characterization process, Scope and Objective of well test. Numerical models and their application, Well test and its types, well testing in different phases of well.

Unit II: Well testing methods and their analysis. **9**

Flow test, RFT, FIT, Drill Stem test, Drawdown test, Multi rate test, Pressure Build Up Test, Bankers Test, Interference test operation and their analysis and interpretation. Well testing methods for Horizontal well and Naturally fractured reservoirs

Unit IV: Well Test Interpretation **9**

Flow Equation, Well Test Interpretation model and its analysis, Radius of investigation, Skin, Well bore radius, Flow efficiency and Damage ratio; Production logging. Case study and Numerical problems.

Unit IV: Gas well testing **9**

Gas well testing: Pseudo Pressure, Pseudo time, AOF, Isochronal, modified Isochronal, interpretation and analysis.

Unit-V: Curve analysis of well test **9**

Decline curves; APRs equation, Harmonic, Hyperbolic, and Exponential Decline curves, Fetkovitch, Blasingame type curves.

Total hours: 45

Course Outcomes:

CO 1: Studentswill get the knowledge about the purpose and uses of the well testing.
CO 2: Students will obtain the knowledge about the application of various well testing techniques**.**
CO 3: Students get the knowledge about the analysis and interpretation of the well testing data.
CO 4: Students will understand the techniques and the methodology for testing the gas well.
CO 5: Students will get the idea of interpreting the gas well data.

TEXT BOOKS

1. Bourdarot,G.“WellTesting,InterpretationMethods”,1stEdition,1996
2. ChaudhryAmanatU,“OilWellTestingHandbook”GulfProfessionalPublishing,2004.
3. LeeW.J,“WellTesting”,TextbookSeries,SPE,Richardson,TX,USA,1982

REFERENCE BOOKS

1. S. McAleese, “Operational Aspects of Oil and Gas Well Testing”, Volume 1 (Handbook of Petroleum ExplorationandProduction)1st Edition,2004.
2. HornRA,“Modern Well Test Analysis, A Computer Aided Approach” , Petroway, Second edition, 1995.
3. Earlougher,R.C., “Advances in Well Test Analysis”, Monograph Series, SPE, 1977

18PCPE54 Hydrocarbon Processing & Plant Engineering 3 0 0 3

Course Objectives: To impart knowledge about the selection and evaluation of processes used to dehydrate natural gas, meet hydrocarbon dew point specifications and extract NGLs. To learn about the application of gas engineering and technology in facilities and gas plants.

Unit I Concepts of Natural Gas Processing, Phase Separation 9

Introduction – process modules – scope of natural gas processing – phase separation – general description - gravity separator - description & design procedure of horizontal separator – selection of separator- advantages and disadvantages of horizontal separator – problems - description & design procedure of vertical separator – advantages and disadvantages of vertical separator –problems.

Unit II Condensate Stabilization & Compression 9

Introduction – process of condensate stabilization –introduction – types of compressors – selection of compressor – advantages of compressor – design procedure – power calculation, condensate hydro treating, effluent treatment.

Unit III Acid Gas Removal 9

Introduction – acid gas removal processes – design considerations – amine absorber – pumps – flash tank – reboiler – stripper – condenser – lean/rich exchanger – cooler – declaimer – design procedure

Unit IV Dehydration 9

Introduction – water content determination – solid desiccant – selection and characteristics of desiccant- process – design procedure, glycol dehydration, solid-bed dehydration, gas dehydration process selection.

UnitV VNGL's 9

Introduction – process- operation – types – design of Fractionator, recovery technology development, recovery unit design considerations, recovery unit operating problems, refrigeration's, recovery processes.

Total hours: 45

Course Outcomes:

Students will be able in

CO1: Formulating the design procedure and selection of Horizontal and Vertical Separators.

CO2: Selecting the types of compressors and power calculation.

CO3: Analyzing the Amine absorption process and associated equipments.

CO4: Implementing the selection of solid bed dehydration and glycol dehydration processes.

CO5: Describing the design of fractionator and to discuss refrigeration and recovery unit operating problems.

TEXT BOOKS

1. KatzD.L."Natural Gas Engineering (Production&storage)",Tata McGraw Hill Singapore, 4th edition, 2009.
2. Alireza Bahadori, Natural Gas Processing Technology and Engineering Design, Ph.D. School of Environment, Science and Engineering, Southern Cross University, Lismore, NSW, Australia.

REFERENCE BOOKS

1. Dipl.-Ing. Klaus H. Lüdtke (auth.)Process Centrifugal Compressors: Basics, Function, Operation, Design, Application;2004

18PCPE55 **Petroleum Testing Lab** **0 0 3 1**

COURSE OBJECTIVES: To introduce various methods of analysis by using sophisticated instruments and analytical equipments to determine various physical properties of crude, natural gas, petroleum products and petro-chemicals. On completion of the course the students should be conversant with the theoretical principles and experimental procedures for quantitative estimation.

List of Experiments:

1. Aromatic content Determination
2. Carbon residue determination
3. Karl-Fisher Conduct meter Apparatus for wate restimation
4. Foaming characteristics of lubeoil
5. Mercaptan as Sulphur estimation
6. Corrosiontesting of petroleum oil sand copper
7. FreezingpointofAqueous Engine coolant solution
8. Automatic Vacuum Distillation
9. Characteristics of Hydrocarbon types in Petroleumproducts
10. Coking tendency ofoil
11. Saybolt calorimeter of petroleum products
12. Water separately of Petroleum products.

Total hours: 40

Course Outcomes:
Students will be able to

CO 1: Perform the various physical and chemical properties of the petroleum products in a safe manner.
CO 2: Differentiate various petroleum products by performing the specific tests.
CO 3: Also able to handle various apparatus/equipment in determining the physical and transport properties of different petroleum products.
CO 4: Students will be able to analyze the various products of petroleum components.

18PCPE56 **Reservoir Engineering Lab** **0 0 3 1**

Course Objectives: To understand various products derived from crude oil, to analyze and solve practical problems Reservoirs- drilling, completion, workover and production field practices and provide solution by designing appropriate systems.

List of Experiments:

1. Interpretation and determination of oil viscosities from Reservoir data.
2. Determination of reservoir heterogeneity
3. Determination of gas compressibility
4. Determination of Bubble Point pressure
5. Construction of Relativepermeability graphs
6. Estimation of vertical sweep efficiency at breakthrough
7. Determination of stabilized flowrate through IPR and TPR.
8. Familiarization of reservoir engineering software.

Total hours: 40

Course Outcomes:

CO 1: The students will become conversant in experimental procedures to acquire process, analyze and interpret the reservoir and reservoir fluid data.
CO 2: Students will be able stabilize flow rate through IPR and TPR curves.
CO 3: This laboratory work makes the students to become good reservoir engineers.
CO 4: Students will be able to analyze and create a representative reservoir models using open source softwares.

Industrial Visit/NSS

Course Objective:

Industrial visit has its own importance in a career of a student who is pursuing a professional degree. It is considered as a part of college curriculum. The objective of an industrial visit is to provide us an insight regarding internal working of companies. We understand that theoretical knowledge is not enough for a successful professional career. With an aim to go beyond academics, industrial visit provides students a practical perspective of the work place. Industrial visits provides an opportunity to learn practically through interaction, working methods and employment practices. It gives students an exposure to current work practices as opposed to possibly theoretical knowledge being taught at college. Industrial visits provide an excellent opportunity to interact with industries and know more about industrial environment. Industrial visits are arranged by VISTAS with an objective of providing us an opportunity to explore different sectors like IT, Manufacturing services, finance and marketing. Industrial visit helps to combine theoretical knowledge with practical knowledge. Industrial realities are opened to the students through industrial visits.

After successful completion of the Personality NSScourse, the student will be able to

CO1: Understand themselves in relation to their community and develop among themselves since of social and civic and responsibility.
CO2: Identify the needs and problem of the community and involve them in problem solving.
CO3: Utilize their knowledge in finding practical solution to individual and community problem.
CO4: Develop the confidence require for group living and sharing of responsibilities of acquire leader ship qualities and democratic attitudes.
CO5: Develop the capacity to meet emergencies and natural disasters and practice national integration and social harmony

18PCPE61 Reservoir Modeling, Simulation & Management 3 0 0 3

Course Objectives: The main of learning this subject is that student will be able understand the Basic reservoir characterization, modeling and simulation methods used in oil industry. The objective of this subject is that student will be able to follow and utilize the different concepts of reservoir modeling and characteristics and their usage.

UNIT – I: Introduction **9**

Overview of reservoir characterization and modeling problems. Reservoir mapping. 3D modeling. Univariate, bivariate and multivariate statistics for geological data analysis. Pattern recognition techniques. Petrophysical predictions from well logs. Introduction to petroleum geostatitsics. Variograms, Kriging, Uncertainty quantification.

UNIT – II: Reservoir modeling **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. Reservoir simulation – Investigation of petroleum reservoir characteristics and behavior, includes: pore volume, fluid distribution and movement, and recovery. The result of simulation studies include optimized field development and management plans which maximize the value and/or reserves of producing properties. Finite difference approximations to the diffusivity equation and the application of those approximations for reservoir simulations. Practical use of reservoir simulation.

UNIT – III: Reservoir characterization **9**

Pressure transient interpretation. Seismic reservoir caracterisation. Log management, correlation and petrophysical analysis. Geology correlator probe–AVO Reservoir Characterization. Software used in reservoir characterization and modeling.

UNIT – IV: Reservoir management **9**

Concepts of reservoir Management – definitions, objectives of management, synergy and team efforts – International business management of joint ventures. Reservoir Management process- Setting goals, developing plan and implementation, Managerial economics, Estimation of production potential.

UNIT -V: Flow assurance **9**

Flow assurance – Identifications of drive mechanism – Bottom hole pressure Management – Forecasting economic scenario. Dynamic reservoir modeling – concept of relative permeability – PVT relationships – Phase behavior – Reserve estimation for identified prospects.

Total hours: 45

Course Outcomes:

Students will be able to

CO1: Evaluate petro-physical parameters from well logs and predict hydrocarbon in place by reservoir mapping and characterization.

CO2: Construct reservoir model by history matching, upscalling, kriging, variograms, andgeostatistics to quantify and qualify the hydrocarbon.

CO3: Acquire the Basics knowledge of Reservoir Modeling Softwares, log management and correlation to predict hydrocarbon bearing zone.

CO4: Familarize and understand various basic concepts of reservoir management, managerial economics, HELP and JVs.
CO5: Predict the phenomenon of various multiphase flows and flow assurance.

TEXT BOOKS

1. JohnR.Fanchi,"PrinciplesofAppliedReservoirSimulation",3rdEdition,2006.
2. Moody, G.B. Slip Slider, H.C. "Petroleum Exploration", Hand Book "World wide Practical Petroleum ReservoirEngineeringMethod",PennWellPublishingCompany,1983.

REFERENCE BOOKS

1. Standard Hand Book of "Petroleum & Natural Gas Engineering" – 2nd Edition 200 William C.Lyons& Gary J.Plisga-Gulf professional publishing comp (Elsevier).

18PCPE62 **Formation Evaluation & Well Logging** **3 0 0 3**

Course Objectives: The main aim of the subject is to give an in depth knowledge about various methods of evaluating the drilled formations and understand the well logging theory and practicing methods. The objective of this course is to have in-depth knowledge is GR logging, SP logging, NMR logging and will be able to interpret different cross plots.

UNIT – I Formation of wells **9**

Definitions of Formation, GTO, cuttings and cores, sampling, testing methods, mud logging/Geo-logging units. Borehole conditions, fundamentals of borehole geophysics, reservoir rock properties, formation parameters, porosity, permeability, resistivity, water and hydrocarbon saturations, movable oil saturations, Archie's and Humbles equation.

UNIT – II Geological logs **9**

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 Log Analysis **9**

Recording, transmission and processing of log data. Formation evaluation for hydrocarbons. Qualitative and quantitative interpretations of well log data. Overlays and cross-plots. 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 Log Inference **9**

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.

UNIT – V Identification and Interpretation **9**

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 saturation. Sub-surface correlation of formations and interpretation of field data.

Total hours: 45

Course Outcomes:

CO1: Evaluate Petro-Physical parameters and rock properties from borehole geophysics.
CO2: Quick Look Analysis and evaluation on various geological logs.
CO3: Interpret Cement Bond Log and basic Production Logs, determine lithology from M-N cross plot.

CO4: Analyze and subsurface correlation of log data for log interference.
CO5: Identification and understanding of various log responses.

TEXT BOOKS

1. Standard Handbook of "Petroleum and Natural Gas Engineering". 2nd Edition, William C.Lyons, Gary C Plisga. Gulf Professional Publishing.
2. Donald P. Helander "Fundamentals Of Formation Evaluation", OGCI Publications,1983.
3. R CSelly "Elements of Petroleum Geology", Academic press Publication.

REFERENCE BOOKS

1. Dewan.J.T"EssentialsofModernOpen-HoleLogInterpretation",PenWellBooks,1983
2. ProceedingsoftheSeminaronExplorationGeophysicsinIndia,February1977,Hyderabad Geophysical methodsandtechniques,"GeophysicalWellLogging"

18PCPE63 Enhanced Oil Recovery & Water flooding 3 0 0 3

COURSE OBJECTIVES: The main of the learning the subject is that student will be able to understand. The basic of oil recovery methods in oil & gas Industry.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.

UNIT I Introduction **9**

Enhanced oil recovery methods – Definition – Schematic representation of enhanced oil Recovery – Techniques involved in EOR – Chemical flooding – Hydrocarbon or Gas injection – Thermal recovery methods.

UNIT II Miscible Displacements **9**

Miscible Displacements- Miscible Slug Process, Enriched-Gas Drive, High-Pressure Gas Injection- Nitrogen and Flue Gas Flooding- CO_2 Miscible Process**,** Laboratory Designs for a CO_2 Flood,Criteria for gas injection.

UNIT III Oil Recovery **9**

Chemical oil recovery methods – Polymer Flooding, Foam Flooding, Surfactant/ MP Flooding, Alkaline flooding, ASP Flooding, Laboratory design for Chemical Flooding, Criteria for chemical recovery methods.

UNIT IV Combustion **9**

Thermal recovery – In-Situ Combustions- Dry Forward Combustion, Reverse Combustion, Wet Combustion, Steam Injection Processes-Screening criteria for steam flood prospects, Oil recovery calculations of Steam Displacement, Mechanism of Steam Stimulation and Steam Displacement– criteria for thermal methods, Steam Assisted Gravity Drainage.

UNIT V EOR Methods **9**

Microbial EOR methods (MEOR)-Definition and Classification of MEOR- Cyclic microbial recovery. Microbial Flooding, Mechanisms of MEOR, Advantages and disadvantages of MEOR

Total hours: 45

Course Outcomes:

Students will be able

CO 1: To create an information about the basic concepts of Enhanced Oil Recovery Mechanisms.

CO 2: To provide a detailed knowledge about the various EOR techniques followed in oil and gas industry.

CO 3: To emphasize the concepts of miscible displacement of hydrocarbon and its application of it.

CO 4: To emphasize the design concepts and selection criteria of CO_2 flooding.

CO 5: To emphasize the concepts of chemical oil recovery method and its application of it.

TEXT BOOKS

1. VonPollen.H.K.andAssociates.Inc.,"FundamentalsofEnhancedoil Recovery" PennWellpublishing co., Tulsa -8th edition,1980.
2. Latil.M.etal.,"Enhancedoilrecovery"– Gulfpublishingco.Houston,3rd edition,1980.

REFERENCE BOOKS

1. Donaldson-Erle,"EnhancedOilRecovery \II William C.Lyons& Gary J.Plisga,
2. 2. "Standard Hand Book of Petroleum & Natural Gas Engineering",Gulf professional publishing comp, 2nd Edition,2005.

18PCPE64 **Heat & MassTransfer Practical** **0 0 31**

Course Objectives: This course is to introduce the basic principles of heat and mass transfer with emphasis on their analysis and applications to practical engineering problems. Also, to identify important thermal processes, and derive the basic expressions for heat conduction, convection and radiation based on the First Law of Thermodynamics.

List of Experiments

1. HeatTransferfromaPin-FinApparatus
2. Heat Transfer through CompositeWall
3. Critical HeatFlux
4. Emissivity MeasurementApparatus
5. HeatTransferthroughtheLaggedPipe
6. Thermal Conductivity ofMetal Rod
7. Heat Transfer in NaturalConvection
8. ParallelFlow/CounterFlowHeatExchanger
9. Heat Transfer in ForcedConvection

Total hours: 40

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Apply Fourier's law to validate the theoretical over all heat transfer coefficient.
CO2: Apply Stefan-Boltzmann law of radiation and emissivity relation.
CO3: Determine thermal properties of material by applying 1-D steady state heat transfer equation.
CO4: Apply non-dimensional numbers to evaluate and validate heat transfer parameters.

18PCPE65 Standards of Training, Certification and Watch-keeping 0 0 3 1

Standards of Training, Certification and Watch-keeping (STCW)

1. **Personal Safety and Social Responsibilities**
   A classroom-based course covering basic induction training in safety procedures and accident prevention, it also familiarises novices with the employment conditions and working environment on board.

2. **Fire Prevention and Fire Fighting**
   Outlines precautions for minimising the risk of fire, the causes of fires and how to extinguish them. Also practical training using fire fighting equipment and breathing apparatus to extinguish various types and sizes of fires.

3. **Personal Survival Techniques**
   Teaches the actions to be taken by individuals to protect themselves in emergency situations and includes practical training using life jackets and inflatable life rafts.

4. **Elementary First Aid**
   A combination of theory and practical training for basic first aid and life-saving skills.

5. **Proficiency in Security Awareness**
   Providing knowledge, understanding and proficiency to personnel intending to work on ships who will not have any designated security duties.

Total hours: 40

Course Outcomes:

Students will be able to

CO1: Familiarize and practice for Personal Safety and Social Responsibilities basic induction training.
CO2: Understand Outlines precautions for Fire Prevention and Fire Fighting techniques.
CO3: Apply practically Personal Survival Techniquesto protect individuals and themselves in emergency situations.
CO4: Understand of Elementary First Aid for life-saving skills.
CO5: Evaluate Proficiency in Security Awareness for safety purpose.

18PRPE66 **SUMMER INTERNSHIP** **0 0 2 1**

Course objectives:

This programme will give the students a taste of real life problem solving in industries. On completion of the internship the students must be able to know about –applications in planning and development, industrial ecology for environment planners, industry planners, public utilities/energy managers

Course Outcomes:

The student shall be able to independently carryout the following tasks:

CO1: Work safely in Industrial environment.
CO2:Work with various interest groups, disciplines, professionals, managers, technicians etc.
CO3: Polish the engineering skills by applying the knowledge in day-to-day operation, troubleshooting and minor-modifications.
CO4: Building relations with University and Industry that will help mutual cooperation over long-term.

18PCPE71 **AUTOCAD** **0 0 3 1**

Course Objectives:

To develop the students ability to prepare the industrial project report. These software tools will be beneficial in analyzing the raw technical data and draw conclusions accordingly. These software applications are practical oriented and industry requirements expertise in this entirely depends on its practice.

Below are some basic features of these software tools.

AUTOCAD is a computer-aided design software program used extensively in all the engineering firms. AutoCAD allows the user to create 2D (two-dimensional) and 3D (three-dimensional) technical drawings using visualization and technical documentation. This software program increases productivity in manufacturing and design, replacing the need for manual drawings and designs. These days most of the engineering companies use AUTOCAD to ramp up productivity on design and manufacturing technologies. It is used to design and create accurate digital prototypes for a wide variety of oil and gas equipment as well.

Application in Petroleum Engineering: This design software will make students understand the workflow across all sections of the oil and gas industry. They can utilize this skill to enhance the industrial project report and provide higher quality documentation.

COURSE OUTCOME:

CO1: Create 2D and 3D computer drawings and models for manufacturing and prototyping.
CO2: Evaluate computer aided design models and assemblies based on critical thinking and problem solving skills.
CO3: Collaborate with people of diverse backgrounds and abilities.
CO4: Develop a solution through group work.
CO5: Communicate and present ideas and solutions to design problems.

Conducting the course: The training in AUTOCAD software should include teaching classes, lab sessions along with user manual provided to the students. Once students are comfortable with 2D model features, the course can be upgraded to 3D version.

Total hours: 40

18HSPE72 PROFESSIONAL ETHICS IN ENGINEERING 2 0 0 2

Course Objectives:

To impart and create an awareness among students on Engineering Ethics and Human Values. To understand social responsibility of an Engineer .To appreciate ethical dilemma while discharging duties in professional life.

Unit I: Human Values 9

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

Unit II: Engineering Ethics 9

Senses of 'Engineering Ethics' - variety of moral issued - 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 - the challenger case study, similarities and contrast of engineering with standard experiments.

Unit IV: Engineer's Responsibility for Safety 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and Chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

Unit V: Global Issues 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics (Specific to a particular Engineering Discipline).

Total hours: 45

Course Outcomes:

CO1: Distinguish between ethical and non ethical situations

CO2: Practise moral judgment in conditions of dilemma

CO3: Relate the code of ethics to social experimentation

CO4: Develop concepts based on moral issues and enquiry

CO5: Resolve moral responsibilities on a global context.

Text Books

1. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, " Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

Reference Books

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available)

2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineering

18PRPE73 **PROJECT-PHASE-I** **0 0 10 5**

Course Objectives:

The student will choose any one Project in consultation with the Guide in their discipline. The student will carry out data collection, Literature studies and Mathematical Modeling calculations independently with the help of the guide. They have to complete the preliminary calculations and preliminary checks. Detailed design will be carried out in phase II of the project.

Course Outcome

CO1: Demonstrate a through and systematic understanding of project contents.
CO2. Understand methodologies and professional way of documentation and communication. CO3. Know the key stages in development of the project.
CO4. Extend or use the idea in mini project for major project
CO5: To develop effective communication skill by delivering a seminar based on final report

18PRPE81 **PROJECT-PHASE-II** **0 0 16 8**

Course Objectives:

The student will be able to carry out detailed design of the project in this phase and he will have to complete the project work by the end of the semester. He will give a seminar presentation on the calculations and drawings carried out to the guide so that he gains more confidence in the design aspects.

Course Outcomes:

CO1: Conduct literature survey to locate for materials and sources relevant to the selected problem area
CO2: Understand the materials obtained and connect the materials with the problem to be solved
CO3: Define and specify the problem precisely
CO4: Assimilate and apply the knowledge learnt in generating good solutions to the problem; CO5: Think critically the formulation of alternative models and solutions to the problem, in the analysis of approaches to the solution and their implementation;
CO6: Evaluate the final outcome in an objective manner;

PROFESSIONAL ELECTIVE COURSES

18PEPE51 Petrochemicals & Petroleum Refining 3 0 0 3

Course Objectives: To provide awareness to Petroleum Refining and Petrochemicals. To enable the students to learn various topics related to distillation, estimation of vapour liquid equilibria, types of distillation equipments and design of distillation columns. Students are expected to have sound knowledge on manufacturing process of petrochemicals.

UNIT I: Introduction 9

Origin, exploration and production of Petroleum, Types of crudes, composition, characteristics, Products Pattern, Indigenous and imported crudes. Crude heating, primary distillation principles, separation of cuts, gaps / overlaps, stripping. Desalting heat balance in distillation, energy input and recovery, vacuum distillation, types of trays, drawoffs, intermediate product, quality control.

UNIT II: Processing 9

Lube oil and wax processing, solvent extraction, dewaxing, desilting, deasphalting, clay contacting, principles operating parameters, feed and product equalities and yields. Types and functions of secondary processing, cracking, thermal cracking and visbreaking, different feed stocks, products, yields and qualities.

UNIT III: Synthesis 9

Fluid catalytic feed stocks and product yields and qualities. Catalyst and operating parameters. Steam Reforming, Hydrogen, Synthesis gas, cracking of gaseous and liquid feed stocks, olefins, Diolofins, Acetylene and Aromatics and their separation.

UNIT IV: Unit Processes 9

Alkylation-alkylation reactions, process variables, alkylation feedstocks, alkylation products, catalysts, Oxidation, Dehydrogenation, Nitration, Chlorination, Sulphonation and Isomerisation.

Unit V: Polymerisation 9

Monomers, polymers and copolymers, classification of polymers, plastics, condensation polymerization, Models and Techniques, production of polyethylene, PVC, Polypropylene, SAN, ABS, SBR, Polyacrylonitrile, Polycarbonates, Polyurethanes, Nylon, PET.

Total hours: 45

COURSE OUTCOMES:

CO1: Identify properties of crude oils and products

CO2: Analyze different types of crude oils

CO3: Understand primary processes

CO4: Understand secondary processes

CO5: Examine suitable technologies to be used in Refinery & Petrochemical processes

TEXT BOOKS

1. B.K. BhaskaraRao,"Modern Petroleum Refining Processes", Oxford and IBH Publishing Company Pvt. Ltd., New Delhi, 3rd edition, 2008.
2. Groggins, "Unit Processing in Organic Synthesis", Tata McGraw Hill, Edition 5, 1987.

REFERENCE BOOKS

1. Nelson W.L., "Petroleum Refinery Engineering", McGraw Hill Publishing Company Limited, 1985
2. Watkins, R.N., "Petroleum Refinery Distillation, second edition, Gulf Publishing Company, Texas 1981

18PEPE52 Natural Gas Engineering 3 0 0 3

Course Objectives: The main of learning this subject is that student will be able to understand the basics of Natural Gas engineering techniques. The objective of studying this subject is that student will be understanding the basic concept and applications of Natural Gas Engineering.

UNIT I Natural Gas 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 Properties of natural gas 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 Gas compression 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 Flow analysis 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 Analysis 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 hours: 45

COURSE OUTCOMES:

CO1: Understand the properties of natural gas.

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

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

CO4: Conversant with different methods of processing of gas

CO5: Understand and apply gas compression fundamentals

TEXT BOOKS

1. Xiuli Wang, Michael Economides, "Advanced Natural Gas Engineering", 1st edition, 2006.

2. Katz D.L.et al., "Natural Gas Engineering" (Production & storage), McGraw-Hill, Singapore, 3rd edition, 2007.

REFERENCE BOOKS

1. Oilfield Processing: Crude Oil (Oilfield Processing of Petroleum R. Solvay, Pennwell Books 1995.

2. Standard Handbook of Petroleum and Natural Gas Engineering, William C Lyons, Gary C Plisga. Gulf Professional Publishing, 2nd Edition, 2004

18PEPE53 Reservoir Rocks & Fluids 3 0 0 3

Course Objectives: The objective of this course is to introduce students to basic reservoir rock and fluid properties. To impart knowledge about various types of rocks with emphasis on the properties and Formation of reservoir rocks and the nature, characteristics and properties of fluids in the reservoir rocks.

Unit I: Introduction 9

Composition and interior of the earth. Minerals and types of rocks – igneous, sedimentary and metamorphic rocks. Formation, structure and textures of igneous and metamorphic rocks. Plate tectonics.

Unit II: Sedimentary Rocks 9

Sedimentary rocks: Formation and types. Sandstone, siltstone, shale, conglomerates. Corbonate rocks – limestone, dolomite. Structure & Texture of sedimentary rocks.

Unit III: Property of Rocks 9

Properties of sedimentary rocks – colour, size, shape, porosity, permeability and their relationship. Electrical, resistivity and atomic properties. Effect of stress and strain, diagenesis, categenesis, metagenesis. Heterogenity– vertical and colour. Clay minerals and their formation and properties

Unit IV: Reservoir fluids 9

Reservoir fluids – oil, gas and water and their relationship. Capillary pressure and its determination, fluid saturation, surface tension, pore size distribution. Wettability, evaluation and alternation of wettability and effect of fluids on rock properties.

Unit V: Fluids Flow Property 9

Flow types, flow regimes, Darcy's law, linear flow, Poiseville's law, flow system, multiple permeability. Fluid properties – Phase behavior of hydrocarbon system. Fluid – rock interface and interaction. Fluid characteristics, PUT analysis. Flash liberation and differential liberation.

Total hours: 45

COURSE OUTCOMES:

CO1:Understands rock deformation, explain the properties of fluid

CO2. Realization of internal and external processes responsible for the dynamics of earth

CO3. Analyze the phenomenon of presence of multiphase flow system in porous media equations for the calculation of parameters

CO4. Develop and explain different drive mechanisms and factor of primary recovery

CO5: Analyze the fluid properties using PVT Analysis

TEXT BOOKS

1. F.J.Peltijohn, “Sedimentary rocks”, 1st edition, 1998
2. Terek Ahmed, “Reservoir Engineering Hand book”, 3rd edition, 2001

REFERENCE BOOKS

1. Craft, B.C. and Hawkins, M.F, “Applied Petroleum Reservoir engineering”, 4th edition, 2003.
2. Amyx. J.W, Bass D.M and whiting R.L “Petroleum Reservoir Engineering”, 1st edition, 1998.

18PEPE54 Pipeline Engineering 3 0 0 3

Course Objectives: Objective and scope of pipeline engineering is to understand the process of fluid transportation with special reference to crude oil/gas/refined products, its construction and maintenance, economics of Pipeline transportation.

UNIT I Design of Pipeline 9

Factors influencing oil, gas and refined products as pipeline design; Hydraulic surge and water hammer; specific heat of liquids; river crossing; pipe size and station spacing etc, load constructions, performance analysis and design

UNIT II Fluid Flow 9

Theory and different formulae of the flow of fluids in oil/gas pipelines; basic equations for the flow of fluids through pipes; different flow equations for laminar and turbulent flow of compressible and incompressible fluids (Newtonian); Introduction to the flow of Non-Newtonian fluids through pipes; multiphase flow and loop pipelines.

UNIT III Construction and Maintenance of pipelines 9

Route location survey, materials; project specifications; general equipment specifications (Pipes, valves and fittings); Installation of expansion loops and thermodymetric tapping plant. Pigging, Pigging Technology: pig launcher and receiver, intelligent pigging, types of pigs.

UNIT IV Offshore Pipeline 9

Design and control of Sag and Over bend; Description of stinger; and Riser, articulated stinger, construction of offshore pipeline, Method of underwater welding, offshore construction,

UNIT V Hydrates, Wax & Scale 9

Formation and prevention of hydrates, wax and scale, Crude conditioning and use of additives to improve flow conditions, inhibition and remediation of hydrates, scale, paraffin of wax, strategies for controlling the solids.

Total Hours: 45

COURSE OUTCOMES:

CO1: Apply the knowledge of Mathematics, Science, and Engineering in property calculations

CO2: Evaluate the Pressure Drop in Oil and Gas Pipelines.

CO3: Analyze the various techniques used in pipeline laying and construction.

CO4: Classify different machinery used for transporting oil and gas.

CO5: Examine Pipeline issues and mitigation measures.

TEXT BOOKS

1. Andrew C. Palme, Roger A. King, “Subsea Pipeline Engineering”, 2nd Edition, Pennwell corporation, 2008
2. BoyunGuo, Shanhong Song, Ali Ghalambor, and Tian Ran Lin, Offshore Pipelines, 2nd edition, Elsevier, 2014.

REFERENCE BOOKS

1. George A. Antaki,“Piping and Pipeline Engineering: Design, Construction, Maintenance, Integrity, and Repair”, CRC Press, 2003.
2. M. Mohitpour, H. Golshan, A. Murray, “Pipeline Design and Construction: A Practical Approach, 3rd edition, 2007.

18PEPE61 **Well Design & Completions** **3 0 0 3**

Course Objectives: To understand the basics of Design and Completion techniques of a well. The objective of studying this subject is that student will be able to design and complete the Well Operation during the hydrocarbon Explorations.

UNIT I:Introduction **9**

Prediction of formation of pore pressure, Causes of abnormal pressure, Abnormal pressure evaluation, Formation integrity test, Fracture gradient determination, geomechanical evaluation, well issues.

UNIT II: Casing properties **9**

Casing properties: functions of casing, Casing properties, Casing specifications, Casing connections, Casing Design principles: Data collection, Factors of influencing casing design, design criteria, Cementing, Drilling Fluids.

UNIT III: Drill bits **9**

Drill Bits: Bit selection guide lines, IADC Bit classification for Roller cone Bits, PDC Bits, Diamond and TSP Bits, Drilling cost calculation, Drill String Design: Drill pipe selection, BHA selection, Drill string design criteria, Directional Drilling.

UNIT IV: Types of wells **9**

Horizontal and Multi lateral wells: Horizontal wells, Extended Reach wells, Multi lateral wells, Multi lateral well planning consideration, HPHT wells, well costing.

UNIT V: Well completion **9**

Well Completion: Definition of Well Completion, Types of completion, Open Hole or Barefoot Completions, Perforated Completions, Naturally Flowing Completions, Artificial Lift Completions, Artificial Lift Methods, Single Zone Completion, Multiple Zone Completions, Phases of Well Completion, completion selection and design criteria.

Total hours: 45

COURSE OUTCOMES:

CO1: Understand basic components of drilling engineering for well planning and design

CO2: Design the well using different parameters

CO3. Understand well control methods and signatures of well in stability

CO4. Know and apply codes for well design

CO5. Understand rig hydraulics

TEXT BOOKS

1. Chaudhry Amanat U, “Oil Well Testing Handbook” Gulf Professional Publishing, 2004.
2. Earlougher, R.C., “Advances in Well Test Analysis”, Monograph Series, SPE, 1977.

REFERENCE BOOKS

1. Devereux, S., “Practical Well Planning and Drilling”, PennWell Corporation, 1998.
2. Lee W. J, “Well Testing”, Textbook Series, SPE, Richardson, TX, USA, 1982

18PEPE62 Offshore Drilling & Production 3 0 0 3

Course Objectives: This course provides a technical overview of the phases, operations, and terminology used in the drilling and completion of an offshore oil or gas well. The course will also provide students with a better understanding of the issues faced in all aspects of drilling operations, with a particular focus on the unique aspects of offshore operations.

Unit-I: Physical Environment 9

Overview of physical ocean environment, geotechnical aspect –sea floor marine soils, composition and properties of sea water, seawater corrosion, offshore rigs, floating drilling vessels, comparison, fixed offshore structures, wind, wave, current and other forces acting on offshore structures, principle motions, metacenter, stability calculations, ballast control, Rov's.

Unit-II: Field Operations 9

Station keeping, conventional mooring system, spread mooring system, design considerations, operations, equipment and functions, Dynamic positioning system, components, working. Deepwater drilling operations, riser system, components, riser tensioners, heave compensator, operations, emergency disconnect and hang off. Floater well control, shut in procedures, well kill operations, subsea well head, BOP stack

Unit-III: Deepwater Drilling 9

Deepwater well construction problems and solutions, deepwater cementation, high temp. High pressure wells, construction, casing and mud policy. Drilling logs, gas hydrate problems. Wellbore stability and rock mechanics, Mohr's coulomb criteria 2D-3D system, insitu stress, poissions ratio, mud window for vertical, horizontal deep water drilling. Case studies.

Unit-IV Development and Production 9

Risers for Production operations, deepwater completion, Subsea completion, planning, tree selection, design considerations of offshore platform, production and processing of oil and gas, separators, design and planning to stage separation, selection, specification and operations, production monitoring and control system. Multilayer producing fields, EOR, offshore field development considerations in deepwater.

Unit-V: Handling and Transportation 9

Offshore storage, handling and transportation of oil and gas tankers**,** vessels and buoys. Structural considerations functions and operations. Loading conditions, selection specification and operational aspect. Advantages and disadvantages. Sub-sea oil and gas lines – Design, construction, installation (laying methods), J- tube installation, and pressure drop calculations for two phase flow including riser behavior. Economics and logistic considerations in exploring, drilling, production, transport and reservoir management. Offshore support vessels, their roles, types, capabilities including fire fighting, pollution control, Different types of barges and their operations. Offshore vessel mounted cranes.

Total hours: 45

COURSE OUTCOMES:

CO1: Explain the offshore sea environment and its challenges, the stability and station keeping mechanism of offshore structures

CO2: Explain applications and limitations of the various fixed and floating offshore drilling/production structures

CO3: Distinguish between the offshore and onshore field development processes

CO4: Understand various production methods used in offshore rigs

CO5: Understand the design calculations in offshore structures

TEXT BOOKS

1. R. Stewart Hall, "Drilling and producing offshore", Pennwell books, 1st edition, 1983.

2. BencGerwickJr, "Construction of Marine and offshore structures", IDT ONGC Dehradun, drilling operations manual.

REFERENCE BOOKS

1. Chakraborty S.K, "Handbook of offshore engineering volume I and II", Elsevier, 2006.Exxon Mobil, "Floating Drilling School, Deepwater", 5th edition, 2002

2. Total Fina Elf, "Deepwater reference book", 4th edition, 2000

18PEPE63 Elements of Reservoir Engineering 3 0 0 3

Course Objectives: To impart knowledge to the students on the basic concept of reservoir engineering, characteristics of crude oil and gas, rock properties, characteristics of reservoir fluids, flow through porous media and various measurements and measuring systems.

UNIT I Introduction 9

Introduction to reservoir engineering, characteristics of crude oil and natural gas, classification of crude and its physicochemical properties, calculation of hydrocarbon volumes, fluid pressure regimes, volumetric gas reservoir engineering.

UNIT II Reservoir Rock Properties 9

Porosity and permeability determination, combination of permeability in parallel & series beds, porosity permeability relationship, fluid saturation determination and significance, effective and relative permeability, wettability, capillary pressure characteristics, measurements and uses. Coring and Core Analysis

UNIT III Reservoir Fluids 9

Phase behavior of hydrocarbon system, ideal & non ideal system, equilibrium ratios, reservoir fluid sampling, PVT properties determination, different correlations and laboratory measurements, data reduction, evaluation and application.

UNIT IV Flow of Fluids through Porous Media 9

Darcy's law, single and multiphase flow, linear, radial & spherical flow, steady state & unsteady state flow, GOR, WOR equations, derivation of the basic radial flow equation, condition of solution.

UNIT V Measuring system 9

Reservoir Pressure Measurements and Significance- Techniques of pressure measurement.
Reservoir Drives: Reservoir drive mechanics and recovery factors. Reserve estimation: resource & reserve concept.

Total hours: 45

COURSE OUTCOMES:

CO1. Identify the nature of Hydrocarbon Reservoir and its affective exploitation - using computer technology through application geoscientific principles.

CO2. Will be able to facilitate for effective estimations of Hydrocarbons together with high degree of confidence using the effective maps and statistical procedure.

CO3. Understand the Risk analysis and its correlations with Resource Managements .

CO4. Will be able to contribute development of software and application of existing software in the arena of Reservoir Engineering.

CO5: Understand the measuring system used in reservoir Engineering.

TEXT BOOKS

1. Tarek Ahmed ,"Reservoir engineering hand book", 3rd edition, Gulf publishing house, 2006.
2. Guo, B, Lyons, W.C. and Ghalambor, A., Petroleum production engineering: a computer assisted approach, Gulf Professional Publishing, Burlington, 3rd edition, 2006.

REFERENCE BOOKS

1. Tarek Ahmed, Paul D Mc Kinney, "Advanced reservoir engineering" Gulf publishing house, 2nd edition, 2005.
2. Abdus Satar, James L Butchwater, "Practical enhanced reservoir engineering" Penwell corporation, 2nd edition, 2007.

18PEPE71 Petroleum Economics 3 0 0 3

Course Objectives: The course provides a comprehensive and up-to-date assessment of upstream petroleum economics, and an introduction to economics analysis of global warming, the potential roles of government and implications for energy markets.

Unit I: Introduction to Petroleum Economics 9

Supply and demand Curve Analysis, Types and utility in production forecast, Reserves to Production Ratio, Statistical analysis, Hubert curves. Reserves auditing, standard practices for reporting of reserves. SEC/ SPE/WPC norms.

Unit II Oil Supply and Demand Curves and Price Determination 9

Crude oil characteristics, Marketing and trading of crude oil, Crude oil pricing mechanism and oil price elasticity, Inflation and effects on oil pricing. Factors controlling oil and gas pricing. Oil differential and influence on price of oil.

Unit III: Pricing and competition 9

Time value of money, types of costs, Economic Yardsticks: Return on Investment, Payout Period, Net Present Value, Discounted Cash How, DCFROR, Incremental Analysis, Replacement Analysis, Sensitivity analysis, Optimization. Ranking of projects based on economic parameters.

Unit IV: Empirical Methods in Energy Economics 9

Definition, Exploration and Production Probabilistic Analysis, Risk Analysis, Management and Economic Assessment, Biding processes, NELP and Production sharing contracts, Decision Analysis, Preference Theory, Real Option Theory, Stochastic Modelling.

Unit V: Issues in Petroleum Economics 9

Petroleum Industry Accounting and types, Petroleum Auditing, Tax Analysis, Cost, Expenditure and revenues under different heads and their proportion in Asset. Depreciation, Depletion, Amortization Methods and their use in tax calculations. E and P Business in world and India, Historical development, Role of OPEC and non OPEC countries. Reasons for development of a fiscal system for petroleum industry. Classification of Petroleum Fiscal Systems.

Total hours: 45

COURSE OUTCOMES:

CO1: Describe the different types of energy resources (conventional, unconventional, renewable & fossil)

CO2: Interpret the evolution of the factors affecting the energy supply and demand (crude prices, technology, reserves, geopolitics, geography, environment, etc.)

CO3: Identify the actors of the energy scene and their strategic guidelines.

CO4: Describe the main steps of the upstream sector.

CO5: Distinguish the different types of oil contracts and explain the main economic criteria to evaluate a project.

TEXT BOOKS

1. Abdel A. A., Bakr A. B, and Al Sahlawi M. A., "Petroleum Economics and Engineering", Decker Publications, 1992.
2. Johnston, D, "International Exploration Economics, Risk, and Contract Analysis", Penwell Books, 2003.
3. "IFP, Oil and Gas Exploration and Product ion, Reserves, Costs and Contracts", Technical Publication 2007.

REFERENCE BOOKS

1. Mian M A, Project Economics and Decision Analysis, Penwell-publications, Volume I and II, 2002.
2. Seba R. D., "Economics of Worldwide Petroleum Production", OGCL-Publications, USA, 1998.

18PEPE72 ADVANCED DRILLING TECHNIQUES 3 0 0 3

Course Objectives: To learn design aspect of well drilling equipments. To understand horizontal, multilateral drilling techniques. To know about wellbore stability and completions. To understand recent developments in drilling technologies

UNIT I **9**

Derrick and block tackle system types, design considerations ton-mile and cutoff practices off drilling line, derrick design considerations.

UNIT II **9**

Casing buckling – Neutral point, axial, radial and tangential stresses and calculations. Corrosion mechanism, casing wear, drill sting operations in H2S environment.

UNIT III **9**

Cement rheology, gas well cementation, drilling logs- temp, CBL, VDL, casing inspection logs, USIP (ultrasonic image tester), IBC (image behind casing), radio active tracer survey, stuck pipe, mud logs, LWD, DST, MWD.

UNIT IV **9**

Well bore stability / rock mechanics – Mohrs coulomb criteria 2D- 3D system, insitu stress. Chemo-poro- thermo- plastic behaviour, pore pressure and Biot's constant, stress around vertical well bore, failure of inclined well bore, Mud window for vertical, horizontal wells, wellbore instability types and causes, hydro fracturing.

UNIT V **9**

Introduction to horizontal and multilateral drilling, MPD, UBD, CTD, deepwater drilling operations. Construction, planning and design aspect. Horizontal well completion, completion sting design vertical and horizontal wells.

Total hours: 45

COURSE OUTCOMES:

CO1: Understand drill string mechanics: loads, cause of failure, design concepts

CO2: Evaluate drilling problems: stuck pipe situations, fishing operations.

CO3: Identify advanced drilling technologies - casing drilling, HPHT, coiled tubing drilling

CO4: Proper selection of drilling technology for shale gas, geothermal drilling, etc.

CO5: Distinguish Non-conventional drilling methods and equipment including environmental aspects of drilling activities

REFERENCE BOOKS:

1) Bourgoyne A.T, Millheim K K, Chenevert M E and Young F S; Applied Drilling Engineering, SPE textbook series. 1991, 508 pp.

2) Carden, R S, Horizontal and Directional Drilling, Petroskills, OGCI, 2007, 409 pp.

3) Mitchell R F, (Editor), Drilling Engineering, Petroleum Engineering handbook, Volume II, 2007, 770 pp.

4) Lyons w, Working Guide to Drilling Equipment and Operations, Gulf Professional Publishing, 2010, 617 pp.

18PEPE73 Unconventional Hydrocarbon Resources 3 0 0 3

Course Objectives: To give comprehensive view of unconventional oil and gas resources and their exploration. Also to understand the place of oil and gas in the domestic and international energy landscape and debate the future of oil and natural gas in the world economy.

UNIT I:Overview of Hydrocarbon Resources 9

Definition of unconventional hydrocarbons – shale gas, coal bed methane, gas hydrates, heavy oil, oil shales, difference between conventional and unconventional resources, carbonate fracture.

UNIT II: Heavy Oil 9

Heavy oil – origin, properties, characteristics, types, generation, occurrence, geology, exploration and evaluation, development and production of unconventional oil, thermal and non thermal recovery methods.

UNIT III: Shale Reservoirs (Gas and Oil) 9

Shale gas, basin centered gas and coal bed methane-origin, origin, properties, characteristics, types, generation occurrence and geology, evaluation and exploration, techniques for shale gas development

UNIT IV: Production and Development 9

Production and development of non-conventional gas, Design for Hydro fracturing and cracking, well operation, production equipments, water disposal, Horizontal wells. Techniques associated with production and development

UNIT V: Gas hydrates 9

Gas hydrates – origin and occurrence. Drilling and completion of wells, gas extraction from gas hydrates. Environmental consideration of unconventional of oil and gas. Economics of development.

Total hours: 45

COURSE OUTCOMES:

CO1: Introducing students to newer hydrocarbon resources including shale gas, coal bed methane, gas hydrates heavy oil and oil shale. They understand and evaluate between conventional and unconventional hydrocarbon resources.

CO2: Evaluate origin, occurrence, development and production of heavy oil.

CO3: Understand exploration, production and development of shale gas.

CO4: Analyze production and development of non-conventional gas

CO5: Familiarize with origin, occurrence and production of gas hydrates.

TEXT BOOKS

1. Carrol John, “Natural gas hydrates: A guide for engineers”, Gulf Publications, 4th edition, 2003.

2. SmithJ.M, “ Chemical Engineering Kinetics”, McGrawHill, 5th edition, 2002

REFERENCE BOOKS

1. Warner HR, “Emerging and Peripheral Technologies in Petroleum Engineering”, volvi, 6th edition, 2007.

2. Fogler H.S., “Elements of Chemical Reaction Engineering”, Prentice Hall of India, 3rd edition, 1998.

3. Farooai Ali Jones S A, Ansmeldau RF, “Practical heavy oil recovery”, 2nd edition, 1997.

18PEPE74 Production Chemicals & oil field chemistry 3 0 0 3

Course Objectives: The objective of this course is for students to highlight the importance of chemistry in Oil field &well treatments. Oil, gas and water supply wells are damaged during their life time. Various types of damage can occur during drilling, completion and production.

UNIT-I Introduction **9**

Role of specialty of production chemicals- Functions, selection and types of drilling mud- Classifications and compositions of drilling mud- Dispersed non-inhibited systems- Chemicals: additives, thickener- Drilling fluid disposal, characterization of drilling fluids- Fluid loss additives- Clay stabilization: types and swelling impedes- Mechanisms causing instability, inhibitors of swelling- Chemicals in detail

UNIT-II Oilfield Metallurgy **9**

Dispersant: low molecular weight dispersant, synthetic, alternative and co-polymers- Natural modified polymers, dispersant for "S"- Reservoir: Bacteria control, mechanisms of growth, Detection of bacteria, mathematical model- Treatments with biocides, non biocide control- Various biocides- Bacterial corrosion- Water shutoff

UNIT- III Corrosion in the Oil Field **9**

Production :Corrosion inhibitors: classification and fields of application- Scale removal treatment , application techniques, amides- Nitrogen based- Poly amine derivatives- Imidazoline corrosion inhibitor, azoles- Carbonyl compounds- Scale inhibitors- Gelling agents

UNIT – IV Oil Field Chemicals **9**

Oil spill- Chemicals in detail- EOR- Polymers- Chemicals in detail- Hydraulic fracturing fluids, Types and characterization- Oil based system- Foam based system, clay stabilization, fluid loss additives, drilling muds, bit lubricants, bacteria control, corrosion inhibitors, scale inhibitors, gelling agents.

UNIT- V Polymer Material **9**

Introduction Polymers and Additives for Cements Corrosion, Asset Integrity Management and Monitoring Standards and Testing. Nanomaterials and Nano-composites, Elastomers and Thermosets for downhole applications Pipes.

Total hours: 45

COURSE OUTCOMES:

CO I: Understanding the role of speciality of chemicals and additives used in oil field industry.

CO II: Explaining the properties and application of a range of chemicals used in corrosion control for oil and gas production.

CO III: Understanding of and ability to evaluate the mechanisms of the various forms of corrosion.

CO IV: Understanding the role of the properties of a range of chemicals used in oil and gas production and their impact on corrosion.

CO V: Discussing Polymers and additives for various forms of corrosion and testing methods

TEXT BOOKS

1. J.K. Borchardt and T.F.Yen,"Oil-Field Chemistry, Enhanced Recovery and Production Stimulation", 1st edition, 1988
2. J. I. DiStasio,"Chemicals for Oil Field Operations", 1st edition, 1981

REFERENCE BOOKS

1. L.J. Zitha, "Well Treatments and Water Shut-off by Polymer Gels", 2000.
2. L.L. Schramm, "Surfactants Fundamentals and Applications in the Oil Industry"- 2000.

18PEPE75 Well Services & Stimulation Techniques 3 0 0 3

Course Objectives: This course is designed to cover all aspects of well stimulation and its importance in increasing productivity of wells beside it discusses acidizing and fracturing quality control, conducting the treatment, monitoring pressures, and other critical parameters, during and after the treatment.

UNIT I:Introduction 9

Introduction – importance of stimulation and work over techniques. Problems likely to be encountered – fishing, hole conditioning, sand encroachment, water and gas coning, pressure depletion, limited production rates, formation damage, wax deposition.

UNIT II: Well Problem Analysis 9

Well problem analysis: Formation damage – selection of mud parameters, hole conditioning methods, bore hole environment, loss circulation, removal of mud cake, fishing – tools and methods.

UNIT III: Fracture - Stimulation 9

Perforation job, squeeze cementing techniques, water and gas shut-off jobs, selection workover-planning rig selection criteria, workover fluids, circulation techniques, tubing retrievel, workover for low permeability well, partially pressure – depleted wells, reduction of water production, reduction of gas production in oil wells, zone transfers.

UNIT IV: Sand Production & Measurement 9

Sand control – reasons for sand production, effects of sand production, control methods-gravel packing screen selection, gravel selection placement techniques.

UNIT V:Acidizing and Acid Fracturing 9

Acidizing concept, types of acids and additives, Carbonate and elastic reservoirs. Hydraulic fracturing – designing of frac job, frac fluids, proppants and additions and their selection, post frac job evaluation.

Total hours: 45

COURSE OUTCOMES:

CO1: Recognise the concept of well completion and workover job for a wellbore.

CO2: Demonstrate well completion, well services and equipments to improve production performance of a wellbore.

CO3. Acquaint with types of well completion.

CO4. Recognise and apply application of techniques to solve well productivity related problems.

CO5. Understand and apply problems related to well.

TEXT BOOKS

1. Earlougher, R.C., "Advances in Well Test Analysis", Monograph Series, SPE, 1977.

2. Michael J. Economides, Larry T. Watters, Shari – Donn "Petroleum Well Construction" –Norman-2001.

REFERENCE BOOKS

1. "Petroleum Production Engineering" – BoyunGuo, william C. Lyons & Ali Ghalambas Elsevier Science & Technology books.

2. Chaudhry Amanat U, "Oil Well Testing Handbook" Gulf Professional Publishing, 2004, 699 pp.

3. Devereux, S., "Practical Well Planning and Drilling", PennWell Corporation, 1998.

18PEPE76 Integrated Oil/Gas Field Evaluation 3 0 0 3

Course Objectives: To impart knowledge on different oil/gas field evaluations in order to maximize the production and improvement of facilities. Students will be able to understand the different evaluation methods of oil/gas fields and reserves.

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, petrophysical 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 hours: 45

COURSE OUTCOMES:

CO1: Analyse and interpret data collected from different sources

CO2: Develop reservoir model using upscaling of available data

CO3: Run basic simulation model using iterations

CO4: Predict the future performance of production of hydrocarbons.

CO5: Apply suitable methods for increase in reservoir efficiency

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.

18PEPE77 Petroleum Equipment Design 3 0 0 3

Course Objectives: To study and analyze suitable equipment for particular reservoir conditions.
Students will be able to understand the concept of designing Equipments for Petroleum Exploration

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 hours: 45

COURSE OUTCOMES:

CO1: Recognize and understand the different components of drilling system.

CO2: Analyse the different flow pattern used in petroleum production system

CO3: Understand and compare the rig data to calculate various problems

CO4: Compare and relate the different treatment processes used in petroleum production system.

CO5: Interpret the storage system patterns and transportation facilities used in petroleum production system

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).

18PEPE78 **Surveying** **3 0 0 3**

Course Objectives: To impart knowledge to the students on the importance of surveying, classification, principles of surveying, linear and angular measurement techniques, various types of instruments used for surveying and the panel table survey method.

UNIT I Introduction to Surveying **9**

Objective of surveying and its importance, Classification, principles of surveying, Application of Surveying in various fields of Engineering, trigonometric levelling, determination of coefficient of refraction.

UNIT II Linear measurements **9**

Conventional Instruments for measuring distances, ranging and chaining out of survey lines, Obstacle in chaining and errors in chaining, corrections-Principles, offsets, booking field notes, problems. Linear measurements (EDMs): Theory and characteristics of electromagnetic waves, radio waves, infra-red, laser waves, principle of distance measurement with EDMs.

UNIT III Angular measurements **9**

Principle and constriction of prismatic compass, bearing of lines, local attraction, magnetic declination and examples. The odolite: The essentials of transit the odolite, definition and terms, temporary adjustments, measurement of horizontal and vertical angles, different operations and sources of error, the odolite traversing, Omited Measurements.

UNIT IV Levelling instruments **9**

Definition, different type of levelling instruments, curvatures and refraction corrections, reciprocal levelling, errors in levelling and problem solving, axial signal correction, difference of elevation

UNIT V Plane Table Surveying **9**

General, Methods, Intersection, Traversing, Resection, two point problem and three points problem etc. Contouring: General, Contour Interval, Characteristics, Methods of locating contours, Interpolation etc.

Total hours: 45

COURSE OUTCOMES:

CO1: Calculate angles, distances and levels

CO2: Identify data collection methods and prepare field notes

CO3: Understand the working principles of survey instruments

CO4: Estimate measurement errors and apply corrections

CO5: Interpret survey data and compute areas and volumes

TEXT BOOKS

1. R.P. Loweth, "Manual of Offshore Surveying for Geoscientists and Engineers" Springer, 1997
2. Paul R Pinet, Invitation to oceanography, 6th edition, Content technologies

REFERENCE BOOKS

1. W. Schofield, "Engineering Survey", 5th edition, Elsevier-2001.
2. B. C. Punima, "Surveying", Firewall media, volume 1, 6th edition, 2005.

18PEPE81 Reservoir Fluid Thermodynamics 3 0 0 3

Course Objectives: To impart knowledge to the students on the work calculation of ideal and non ideal gases, horse power, thermodynamics of gases and liquid hydrocarbons, phase rule of single, two, three multi- component and multi-phase systems.

UNIT I Work Calculations 9

Work calculation for compression/ expansion of ideal and non ideal gases, compression cycles and horse power calculations - single, double and multistage with and without clearance.

UNIT II Thermodynamics of Gases and Liquid Hydrocarbons 9

Free energy & work function, Mollier diagrams, perfect & imperfect gaseous mixtures, Equation of state, Law of corresponding states, Joule Thompson effect, Arrhineous equation and activation energy. Fugacity and fugacity coefficient of gases and gaseous mixtures, Lewis fugacity rules and Third law of thermodynamics.

UNIT III Solution Thermodynamics 9

Vapour liquid equilibria, equilibrium constant, partial molar properties, chemical potential, Raoult's law and Henry's law, ideal and non ideal solutions, Activity and activity coefficients, Gibb's Duhem equation, Gibb's adsorption equation.

UNIT IV Phase Rule 9

Phase rule of single, two, three, multi-component and multi phase systems, phase behaviour indifferent conditions, Thermodynamic aspects of phase equilibria. Calculation of phase equilibria, Ternary and pseudo ternary phase diagrams

UNIT V Fluid Flow Thermodynamics 9

Single phase flow & multiphase flow through vertical, incline and horizontal conduits. Pressure traverse curves and their applications. Venturi flow, nozzle flow, pipe internal flow, annular flow and nozzle flow thermodynamics of multiphase &multi-component system.

Total hours: 45

COURSE OUTCOMES:

CO1: Apply the knowledge of First law of thermodynamics to solve the problems.

CO2: Explain various properties of fluids like pressure, temperature and volume, influencing its behavior under various conditions of phase equilibrium

CO3: Apply the knowledge of second and third law of thermodynamics to solve the practical problems.

CO4: Discuss the knowledge to Steady-Flow Process

CO5: Classify different types of oil and gas reservoirs based on the Fundamentals of reservoir fluid behavior and properties

TEXT BOOKS

1 Karen Schou Pedersen, Peter L. Christensen, Jawad Azeem Shaikh, "Phase Behavior of Petroleum Reservoir Fluids" 2nd edition, CRC Press, 1998.

2. Abbas Firoozabadi, "Thermodynamics of Hydrocarbon Reservoirs"1st Edition, McGraw Hill, 1999.

REFERENCE BOOKS

1. Ali Danesh, "PVT and Phase Behaviour of Petroleum Reservoir Fluids", Elsevier, 1998

2. J. Hagoort, "Fundamentals of Gas Reservoir Engineering", Elsevier, 1988

18PEPE82 Petroleum Storage, Transportation& Marketing 3 0 0 3

Course Objectives: To impart the students with the various elements and stages involved in Transportation of oil and gas, storage and marketing. To understand the key techno-economic parameters of petroleum storage and transportation and sense real time scenario of global oil and gas trading.

UNIT: I Introduction 9

Transportation of petroleum & petroleum products. Transportation modes. Storage methods. Basics of pipeline construction, operation and protection. Pump and compressor stations. Instrumentation and control.

UNIT: II Petroleum Storage 9

Metering and measurements of oil and gas. Indian and Global supply scenario of petroleum and petroleum products. Product quality control. Storage of petroleum products in fixed installations. Standards and regulations. Types of storage tanks. Underground storage of natural gas. Bulk distribution and handling- domestic, commercial and industrial.

UNIT: III Oil Pricing & Control Mechanism 9

Role of International oil companies and OPEC pricing mechanism. Administered and Market determined pricing mechanism in India. Conservation of petroleum & its products, Spot and other market control mechanism. Indian and Global supply scenario of petroleum and petroleum products.

UNIT: IV Pricing 9

Oil and Gas Prices: International Market and Geo politics, Crude oil characteristics, Marketing and trading of crude oil, Crude oil pricing, Mechanism and oil price elasticity. Issues in domestic petroleum pricing.

UNIT: V Pricing Economy strategy 9

Inflation and effects on oil pricing. Factors controlling oil and gas pricing. Oil differential and influence on price of oil. Economics of long distance pipeline. Governments pricing policy for petroleum products.

Total hours: 45

COURSE OUTCOMES:

CO1: Choose an effective transportation mode for petroleum products

CO2: Incorporate a suitable storage facilities for a specific petroleum

CO3: Integrate global oil pricing and their control mechanism

CO4: Summarize international crude oil market and price

CO5: Estimate the cost of long distance pipeline

TEXT BOOKS

1 Oil & Natural Gas Transportation & Storage Infrastructure: Status, Trends, & Economic Benefits, report for American Petroleum Institute, IHS Global Inc, 2013.

2 Alex Marks, Petroleum Storage Principles, PennWell Books, 1983.

3 Harold Sill Bell, Petroleum Transportation Handbook, McGraw-Hill, 1963.

4 William Henry Day, Petroleum marketing practices and problems**,** Commercial Publishers,1966

REFERENCE BOOKS

1 Morris Albert Adelman, The World Petroleum Market, The Johns Hopkins university press 1973.

2 Petroleum Marketing and Transportation**,** Dallas (Tex.) International Oil and Gas Educational Center, Gulf Publishing Company, 1964

18PEPE83 Elements of Reservoir Engineering 3 0 0 3

Course Objectives: To impart knowledge to the students on the basic concept of reservoir engineering, characteristics of crude oil and gas, rock properties, characteristics of reservoir fluids, flow through porous media and various measurements and measuring systems.

UNIT I Introduction 9

Introduction to reservoir engineering, characteristics of crude oil and natural gas, classification of crude and its physicochemical properties, calculation of hydrocarbon volumes, fluid pressure regimes, volumetric gas reservoir engineering.

UNIT II Reservoir Rock Properties 9

Porosity and permeability determination, combination of permeability in parallel & series beds, porosity permeability relationship, fluid saturation determination and significance, effective and relative permeability, wettability, capillary pressure characteristics, measurements and uses. Coring and Core Analysis

UNIT III Reservoir Fluids 9

Phase behavior of hydrocarbon system, ideal & non ideal system, equilibrium ratios, reservoir fluid sampling, PVT properties determination, different correlations and laboratory measurements, data reduction, evaluation and application.

UNIT IV Flow of Fluids through Porous Media 9

Darcy's law, single and multiphase flow, linear, radial & spherical flow, steady state & unsteady state flow, GOR, WOR equations, derivation of the basic radial flow equation, condition of solution.

UNIT V Measuring system 9

Reservoir Pressure Measurements and Significance- Techniques of pressure measurement.
Reservoir Drives: Reservoir drive mechanics and recovery factors. Reserve estimation: resource & reserve concept.

Total hours: 45

COURSE OUTCOMES:

CO 1: Evaluating the characteristics and physicochemical properties of crude oil.

CO 2: Determining the rock and fluid properties of reservoir and coring analysis.

CO 3: Do calculations on basic PVT analysis of the specific reservoir of various sands.

CO 4: Deriving equations of flow of fluids through porous media.

CO 5: Estimating the reserves of various sands of the reservoir from well data and reservoir pressure measurements.

TEXT BOOKS

3. Tarek Ahmed ,"Reservoir engineering hand book", 3rd edition, Gulf publishing house, 2006.

4. Guo, B, Lyons, W.C. and Ghalambor, A., Petroleum production engineering: a computer assisted approach, Gulf Professional Publishing, Burlington, 3rd edition, 2006.

REFERENCE BOOKS

3. Tarek Ahmed, Paul D Mc Kinney, "Advanced reservoir engineering" Gulf publishing house, 2nd edition, 2005.

4. Abdus Satar, James L Butchwater, "Practical enhanced reservoir engineering" Penwell corporation, 2nd edition, 2007.

18PEPE84 Process Instrumentation Dynamics and Control 3 0 0 3

Course Objectives:

To introduce control equipments used to control the production process of a chemical Factory and to introduce the control mechanism through automation and computers. Gains knowledge in designing a control system and identifying the alternative control configuration for a given process plant or entire plant. He will be familiar with the control mechanism before attempting to tackle process control problems.

UNITI Introduction 9

Laplace transformation, transform of standard functions, derivatives and integrals, inversion, theorems in Laplace transformation, application .Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics, transfer function for chemical reactors and dynamics.

UNITII Closed loop system 9

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

UNITIII Open loop system 9

Introduction to frequency response of closed-loop systems, open loop control system, control system design by frequency, Bode diagram, stability criterion, Nyquist-diagram; Tuning of controller settings.

UNITIV Advanced control system 9

Controller mechanism, introduction to advanced control systems, cascade control, feed forward control, control of distillation towers and heat exchangers, introduction to microprocessors and computer control of chemical processes.

UNITV Measurements & Instruments 9

Principles of measurements and classification of process control instruments, measurements of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity and consistency, pH, concentration, electrical and thermal conductivity, humidity of gases, composition by physical and chemical properties and spectroscopy.

Total hours: 45

COURSE OUTCOMES:

CO1: Explain the basic principles & importance of process control in industrial process plants;

CO2: Specify the required instrumentation and final elements to ensure that well-tuned control is achieved;

CO3: Explain the use of block diagrams & the mathematical basis for the design of control systems;

CO4: Design and tune process (PID) controllers;

CO5: Analyzing plant dynamics and the design of well tuned control loops;

TEXTBOOKS

1. CoughnowrandKoppel,"ProcessSystemsAnalysisandControl",McGraw-Hill,New York, 1986.
2. George Stephanopolous, "Chemical Process Control", Prentice-Hall of India Pvt. Ltd., New Delhi, 1990.
3. Patranabis.D, Principles of Process control, II edition, Tata McGraw-Hill Publishing Co.Ltd, 1981.
4. Peter Harriott, Process control, Tata McGraw-Hill Publishing Co., Reprint 2004.

REFERENCE BOOKS

1 Thomas, E. Marlin, Process Control, 2nd Edn, McGraw-Hills International Edn. 2000.
2 George Stephanopoulos, Chemical Process Control, Prentice Hall of India 2003.
3 Norman H.Ceaglske, Automatic process control for chemical engineers, John
4 Wiley & Sons, Japan.
5 Emenule, S. Savas, "Computer Control of Industrial Processes", McGraw-Hill, London, 1965.
6 Eckman, D.P., "Industrial Instrumentation", Wiley, 1978.

18PEPE85 Multi-component Distillation 3 0 0 3

Course Objectives: To enable the students to understand the basic principles of thermodynamics, thermodynamic property of multi-component mixtures, minimum reflex ratio of MCD systems, properties and Methods of MCD column design

UNIT I Thermodynamic Principles 9

Fundamental Thermodynamic principles involved in the calculation of vapour– 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 vapour phase of polar gas mixtures– calculation of liquid– phase activity coefficients.

UNIT II Thermodynamic Property Evaluation 9

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

UNIT III Minimum reflux ratio for MCD System 9

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

UNIT IV Various Methods of MCD Column Design 9

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

UNIT V Various Types of MCD Columns 9

Design of sieve, bubble cap, valve tray sand structured packing columns for multi-component distillation– computation of plate efficiencies, principle type of reactors, screening, mixing.

Total hours: 45

COURSE OUTCOMES:

CO1: Determine bubble point and dew point for multicomponent mixtures using K-values and relative volatility.

CO2: Determine minimum reflux ratio, minimum no. of stages, feed tray location, and distribution of key components using various shortcut methods.

CO3: Determine the number of stages in multi-stage multicomponent towers by various rigorous calculation methods.

CO4: Make calculations of multicomponent single stage operations like flash vaporization, differential distillation and steam distillation.

CO5: Carry out the design of azeotropic distillation and extractive distillation systems

TEXT BOOKS

1. Holland, C.D., "Fundamentals of MultiComponent Distillation", McGraw Hill Book Company, 1981
2. Van Winkle, "Distillation Operations", McGraw Hill Publications, 1987.

REFERENCE BOOKS

1. S.B.Thakore & B.I.Bhatt, "Introduction to process engineering and design", Tata McGraw-Hill, 2007.
2. P.B.Despande, " Distillation dynamics and control", Arnold USA 1985

18PEPE86 WELL CONTROL METHODS 3 0 0 3

Course Objectives: To Understand Well control operation during drilling for blow out prevention. To Understand Well control technology for horizontal, multilateral, ERD wells, and deep water drilling.

UNIT I Basic terms, bottom hole pressure 9

BHP, Normal , abnormal pressure, causes, U tube concept, shallow gas, top hole drilling with riser, gas cutting effect of gas expansion in riser, swab ,surge effect , scr ,choke line friction, ECD.

UNIT II Kick indication and shut in procedure 9

Causes of kicks, kick signs, shut in procedure for land, jack up, floating rig, type of influx, influx behavior, close circulation

UNIT III Blow out preventer equipment surface / subsea 9

Annular, ram preventer, packing element , accumulator system, sizing of accumulator surface and subsea unit , Kelly cock, safety valve , IBOP , check valve , bit float, subsea BOP stack and control system , choke manifold , kill manifold, diverters, function and pressure test, mud gas separator, vacuum degaser, rotating head, rotating BOP.

UNIT IV Well killing method 9

Driller's method, wait weight method, comparison, pressure behavior at different points during killing, volumetric method, subsea considerations, stripping and snubbing, well control considerations for horizontal wells , multilateral wells, associated problems.

UNIT V Unusual situations in well control 9

Plugged nozzles, pump failure, plugged and washed choke, string wash out , lost circulation, reversing out of influx through drill pipe , bull heading, hydrate formation, problems and their remedial actions

Total hours: 45

COURSE OUTCOMES:

CO1: Understand the physical principles and concepts related to maintaining and regaining pressure control of wells while drilling.

CO2: Starting from concepts of formation pressure, fracture pressure, and factors which affect inflow, student will gain an understanding of the elements of primary and secondary well control methods.

CO3: Evalaute0 Well designs to improve pressure containment and reduce risk of secondary well control situations will be covered in detail.

CO4: Identify potential well control situations in advance of their occurrence. A brief overview of well control equipment, their operation, and testing will be covered to the extent necessary for the

participants to identify requirements in the well planning phase.

CO5: Understand Classical well control methods will be covered and several well control problems will be worked using several standard well control worksheets.

TEXT BOOKS:

1. Robert D Grace, Advanced Blowout and Well Control, Gulf Publishing Company, 1994, 414 pp.
2. David Watson, Terry Brittenham, and Preston L. Moore, Advanced Well Control, Society of Petroleum Engineers, 2003, 386 pp.
3. Neel Adams, Well Control Problems and Solutions, Petroleum Publishing company, 1980, 683 pp.
4. IWCF manual, 2007
5. IADC, Well Control Manual, 2009.

OPEN ELECTIVE COURSES

18OEPE51 Statistics and Linear Programming 3 0 0 3

Course Objectives: This course presents the theory, application and algorithms relevant to solving linear programming problems. Also includes the simplex method for linear programming, duality and sensitivity analysis. To understand the basic theory behind LP, algorithms to solve LPs, and the basics of (mixed) integer programs (ILP).

Unit I:Testing of Hypothesis **9**

Sampling distributions- Tests for single mean , proportion and difference of means (large and small samples)– Tests for single variance and equality of variances– Chi-Square test for goodness of fit– Independence of attributes– Non-parametric tests: Test for Randomness and Rank-sum test (Wilcoxon test).

Unit II: Design of experiments **9**

Randomization and Design - Randomization against Confounding- Randomization for Inference- Structure of Completely Randomized Designs- Preliminary Exploratory Analysis- Models and Parameters- Estimating Parameters.

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Unit III: Statistical Quality Control **9**

Categories of statistical quality control (SQC)- Acceptance Sampling- Control charts for measurements (X charts and R charts)– Control charts for attributes(p charts, C charts and Np -charts)– Tolerance limits-Acceptance sampling.

Unit IV; Linear programming **9**

The Standard Maximum and Minimum Problems-Dual Linear Programming Problems-Formulation – Graphical solution – Simplex method – Big-M method-Transportation and Assignment models, fundamental theorem of linear programming,

Unit V: Advanced Linear Programming **9**

Introduction about large L.P. problems, Graphical solution- Geometric interpretation-Duality– Dual simplex method–Integer programming – Cutting-plane method.- the primal-dual algorithm, and Wolfe-Dantzig decomposition.

Total hours: 45

COURSE OUTCOMES:

CO1: Describe the basic concepts of convex analysis and explain the theoretical foundations of various issues related to linear programming modelling

CO2: Formulate real-world problems as a linear programming model and describe the theoretical workings of the graphical and simplex method, demonstrate the solution process by hand and solver

CO3: Explain the relationship between a linear program and its dual, including strong duality and complementary slackness

CO4: Perform sensitivity analysis to identify the direction and magnitude of change of a linear programming model's optimal solution as the input data change

CO5: Formulate specialized linear programming problems, namely transportation problems

TEXT BOOKS

1. Johnson, R.A. and Gupta, C.B., Miller and Freunds "Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, (2007).
2. TahaH.A. ,"Operations Research", Pearson Education, Asia, 8th edition, (2007).

REFERENCE BOOKS

1. Devore, J.L., "Probability and Statistics for Engineering and the Sciences" Thomson Brooks/Cole, International Student Edition, 7th edition, (2008).
2. Winston,W.L., "Operations Research–Applications and Algorithms", Thomson, 1st Indian Reprint, 4th edition, (2007).

18OEPE52 Professional Ethics 3 0 0 3

Course Objectives: To impart and create awareness among students on Engineering Ethics and Human Values. To understand social responsibility of an Engineer .To appreciate ethical dilemma while discharging duties in professional life.

UNIT I Human Values 9

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

UNIT IIEngineering Ethics 9

Senses of 'Engineering Ethics' - variety of moral issued - 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 - the challenger case study, similarities and contrast of engineering with standard experiments.

UNIT IV Engineer's Responsibility for Safety 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and Chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT VGlobal Issues 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics (Specific to a particular Engineering Discipline).

Total hours: 45

COURSE OUTCOMES:

CO1: Understanding basic purpose of profession, professional ethics and various moral and social issues.

CO2: Awareness of professional rights and responsibilities of a Engineer, safety and risk benefit analysis of a Engineer

CO3: Acquiring knowledge of various roles of Enbgineer In applying ethical principles at various professional levels

CO4: Professional Ethical values and contemporary issues

CO5: Excelling in competitive and challenging environment to contribute to industrial growth.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, “Ethics in engineering”, McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “ Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.

REFERENCE BOOKS

1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available)
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. 4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.

18OEPE61 **Energy Technology** **3 0 0 3**

Course Objectives: This Course provides an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application. The class will explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, and hydro.

Unit I Energy **9**

Units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Renewable and non-renewable energy sources and their availability. Prospects of Renewable energy sources

Unit II Conventional Energy **9**

Conventional energy resources, Thermal, tydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

Unit III Non-Conventional Energy **9**

Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India ,energy plantations. Wind energy, types of wind-mills, types of wind rotors, Darrieus rotor and Gravian rotor ,wind electric power generation ,wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

Unit IV Biomass Energy **9**

Biomass energy resources, thermo-chemical and biochemical methods of biomass conversion, combustion, gasification, pyrolysis, biogas production, ethanol, fuel cells, alkaline fuel cell, phosphoric acid fuel-cell, molten carbonate fuel cell, solid oxide fuel cell, solid polymer electrolyte fuel-cell, magneto hydrodynamic power generation, energy storage routes like thermal energy storage, chemical, mechanical storage and electrical storage.

Unit V Energy Conservation **9**

Energy conservation in chemical process plants, energy audit, energy saving in heat exchangers, distillation columns, dryers, ovens and furnaces and boilers, steam economyin chemical plants, energy conservation.

Total hours: 45

COURSE OUTCOMES:

CO1: Have a basic knowledge of the principles of Fuel Cells and its components, types of Fuel Cells, performance characteristics, and applications of Fuel Cells.

CO2: Have a basic knowledge of Hydrogen Energy, Properties of Hydrogen, Production methods and purification, Storage methods, Environmental benefits and its Applications in the Hydrogen Economy.

CO3: Have a basic knowledge of Ocean energy resources and technologies including Tidal energy, Wave power devices, OTEC, Bio Photolysis, Ocean currents and Salinity gradient devices.

CO4: Have a basic knowledge of the principles of Magneto Hydro Dynamic power generation system, and it applications & technologies.

CO5: Understand thermodynamic process taking place in energy conservation and waste heat recovery.

TEXT BOOKS

1. Rao, S. and Parulekar,B.B., "Energy Technology", Khanna Publishers, 2005.
2. Rai, G.D., "Non-conventional Energy Sources", Khanna Publishers, NewDelhi, 1984.
3. Bansal, N.K., Kleeman, M. and Meliss, M., "Renewable Energy Sources and Conversion Technology", Tata McGraw Hill, 1990.
4. Nagpal, G.R., "Power Plant Engineering", Khanna Publishers, 2008.

REFERENCE BOOKS

1. Nejat Vezirog, "Alternate Energy Sources", IT, McGraw Hill, New York.
2. El. Wakil, "Power Plant Technology", Tata McGraw Hill, New York, 2002.
3. Sukhatme. S.P., "Solar Energy-Thermal Collection and Storage", Tata McGraw hill, NewDelhi, 1981.

18OEPE62 Equilibrium Staged Operations 3 0 0 3

Course Objectives: To impart knowledge on the design of different staged operations using the concept of equilibrium. The students will learn in detail the unifying theory and design of different staged operations like absorption, distillation, extraction and adsorption.

Unit I -Absorption **9**

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

Unit II-Distillation **9**

Vapour liquid equilibria – Raoult's law, vapour– liquid equilibrium diagrams for ideal and non- idealsystems,enthalpyconcentrationdiagrams.Principleofdistillation – flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by Mc.Cabe- Thiele method and Ponchan, Savarit method,

Total reflux, minimum reflux ratio,optimum reflux ratio. Desing of azeotropic and extractive distillation columns.

Unit III- Multi-component Distillation **9**

Fundamental principles involved in the separation of multi-component mixtures – equilibrium flash distillation calculations for multi-component mixtures–separation of multi-component mixtures at total reflux. Calculation of minimum reflux ratio. Determination of number of trays

Unit IV- Liquid Extraction **9**

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

Unit V-Adsorption &Membrane separation Process **9**

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

Total hours: 45

COURSE OUTCOMES:

CO1: Describe basic principles of various equilibrium staged operations involving material and energy balances

CO2: Determine the number of equilibrium stages required for distillation and absorption units

CO3: Determine number of transfer units and height requirements required for extraction, leaching and adsorption units

CO4: Explain different column/equipment used for various separation applications

CO5: Recognize modern separation techniques applied in industries for high purity products

TEXT BOOKS

1. Wankat, P, "Equilibrium Stage Separations", Prentice Hall.
2. Treybal, R.E. ,"Mass Transfer Operations ", 3rdEdn., McGraw-Hill.
3. Seader, J.D. and E.J. Henley, “Separation Process Principles”, 2nd Ed., John Wiley,2006.

REFERENCE BOOKS

1. W.L .McCabe, J.C. Smith, and Harriot. P, "Unit Operations of Chemical Engineering", sixth edition McGraw-Hill. International Edition, 2001.
2. C.Judson King "Separation Processes", Tata McGraw-Hill1974.
3. R.F.Strigle(jr), “Packed Tower Design and Application”, 2nd edition, Gulf Publishing company.

18OEPE71 Supply Chain Management 3 0 0 3

Course Objectives: To understand the various decision phases in a supply chain, to be aware of the Supply Chain and its drivers, to design Supply Chain Network, to build a aggregate plan in supply chain, to understand Sourcing Decisions in Supply Chain to comprehend the influence of Information technology in Supply Chain

UNIT I Introduction to Supply Chain 9

Understanding Supply Chain- The Development Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Key issues in Supply Chain Management Achieving strategic fit – Expanding Strategic scope

UNIT II Supply Chain Drivers and Design 9

Drivers of supply chain performance – Designing distribution network – Network Design in the Supply Chain - Network design in Uncertain Environment-Implementing a competitive approach to Warehousing and Distribution

UNIT III Aggregate Planning and Managing Supply, Demand and Inventory 9

Aggregate Planning in a Supply chain: role - Managing Supply – Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Methodology of Supply Chain Management project-solutions-Level of product availability.

UNIT IV Sourcing and Transportation 9

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

UNIT V Information Technology in a Supply Chain 9

Information technology in a supply chain – Impact and benefits of IT in supply chain management-CRM, ISCM, SRM in supply chain - Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

Total hours: 45

COURSE OUTCOMES:

CO1: Critically evaluate the principles of supply chain management

CO2: Design, organize and effectively manage a supply network, taking account in particular of supply strategy, inter-organizational relationships and logistics issues

CO3: Apply forecasting and purchasing/Inventory concepts to improve supply chain operations

CO4: Use logistics technology tools and resources, in order to comply with the requirements of logistics/supply chain management.

CO5: Utilize information and internet technology systems proficiently to• support logistics management decisions.

TEXT BOOKS

1. Sunil Chopra and Peter Meindl, "Supply Chain Management-Strategy Planning Indian Reprint, 2010.

2. Jananth Shah "Supply Chain Management – Text and Cases", Pearson and Operation", Pearson Education, 4thEducation, 2008.

REFERENCE BOOKS

1. Altekar Rahul V, "Supply Chain Management-Concept and Cases", Prentice Hall India, 2005.

2. Monczka et al., "Purchasing and Supply Chain Management", Thomson Learning, 2nd Edition, 2 Reprint, 2002.

18OEPE81 Total Quality Management 3 0 0 3

Course Objectives: To understand the various principles, practices of TQM to achieve quality. To get acquainted with the various statistical tools and approaches for quality control and continuous improvement. To get aware of the importance of ISO and Quality Systems.

UNIT I INTRODUCTION 8

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs -Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES 7

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement –Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

UNIT III TQM IMPROVEMENT PROCESS 8

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT IV STATISTICAL PROCESS CONTROL (SPC) 8

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

UNIT VI QUALITY SYSTEMS 7

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System– Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

Total hour: 45

COURSE OUTCOMES:

CO1: Student will able to explain the quality management philosophies and frameworks

CO2: Students will know the various tools and techniques of quality management

CO3: Students will able to apply quality tools and techniques in both manufacturing and service industry

CO4: Analyze benchmarking process used in total productive maintenance and in various stages of FMEA

CO5: Student will able to explain the quality systems and energy auditing process.

TEXT BOOKS

1. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education ,Inc. 2003.
2. Feigenbaum.A.V., "Total Quality Management", McGraw-Hill, 1991.
3. Narayana V. and Sreenivasan. N.S., "Quality Management – Concepts and Tasks", New Age International, 1996.

REFERENCE BOOKS

1. James R.Evans& William M.Lidsay, "The Management and Control of Quality", 5th Edition, South-Western (Thomson Learning), 2002.
2. Oakland.J.S., "Total Quality Management", Butterworth Hcinemann Ltd., Oxford,1989.
3. Zeiri, "Total Quality Management for Engineers", Wood Head Publishers, 1998.

18OEPE82 ENERGY AUDIT AND ENERGY CONSERVATION METHODS 3 0 0 3

COURSE OBJECTIVE:

This course provides the knowledge about energy audit and energy conservation methods in I.C. Engines.

UNIT I ENERGY AND ENVIRONMENT 9

Introduction - fossil fuels reserves - world energy consumption - green house effect, global warming - Renewable energy sources - environmental aspects utilization - energy prizes - energy policies.

UNIT II ENERGY CONSERVATION 9

Energy conservation schemes - industrial energy use - energy surveying and auditing - energy index – Energy cost - cost index - energy conservation in engineering and process industry, in thermal Systems, in buildings and non-conventional energy resources scheme

UNIT III ENERGY TECHNOLOGIES 9

Fuels and consumption - boilers - furnaces - waste heat recovery systems - heat pumps and Refrigerators - storage systems - insulated pipe work systems - heat exchangers.

UNIT IV ENERGY MANAGEMENT 9

Energy management principles - energy resource management - energy management information Systems - instrumentation and measurement - computerized energy management - energy Auditing.

UNIT V ECONOMICS AND FINANCE 9

Costing techniques - cost optimization - optimal target investment schedule - financial appraisal and Profitability - project management.

TOTAL: 45 Hours

COURSE OUTCOMES:

CO1: Understanding the basics of demand side management and mechanisms (technical, legal or financial) that influences energy consumption. Recognizing opportunities for increasing rational use of energy.

CO2: Understanding the basics of energy auditing with application on different sectors.

CO3: Understood and acquired fundamental knowledge on the science of energy and on both the conventional and non-conventional energy technologies

CO4: Acquired the skills needed for the energy monitoring, auditing and management.

CO5: Capable of design and analysis of energy conversion systems.

TEXT BOOKS:

1. MurphyW.R. and McKAYG.,"Energy Management, Butterworths, London, 1982.
2. TrivediP.R.,JulkaB.R., "Energy Management",Common wealth publishers, 1997.

REFERENCE BOOKS:

1. David Merick, Richard Marshal, "Energy, present and future options", Vol. I and II, John Wiley and Sons, 1981.
2. Chaigier N.A. "Energy Consumption and Environment ", McGraw-Hill, 1981.
3. Ikken P.A. Swart R.J and Zwerves.S, "Climate and Energy ", 1989.
4. Ray D.A. "Industrial Energy Conservsation

Humanities and Social Sciences Elective Courses

18HSPE31 PERSONALITY DEVELOPMENT I 2 0 0 2

COURSE OBJECTIVE:

- To improve the interpersonal skills, soft skills, effective team player and analyze strength and weakness to meet their professional career.

UNIT I SOFT SKILLS I 6

Introduction to Personality Development – Meaning-Features of personality=Dimensions of Personality=Determinants of Personality-Features and Traits- Components of self concept-Barriers-Self analysis

UNIT II SOFT SKILLS II 6

Importance of Soft Skills – First impression-Work Place requirements-Discipline-Cleanliness-Hygiene-general Appearance--Building Confidence—Concept of Thinking and Usage-Value of Time-Focus & Commitment.

UNIT III SOFT SKILLS IN ACTION 6

Grooming – Attire – Understanding others- – Stability & Maturity Development – Strengths – Weakness – Opportunities-threats -Merits of SWOT Analysis-Components-how to convert weakness into strengths-Goal settings

UNIT IV SELF AWARENESS AND SELF ESTEEM 6

Definitions-Components of self awareness-Developing Self awareness-Self esteem-meaning-Steps to improve self esteem

UNIT V SELF MOTIVATION 6

Motivation –Meaning-Techniques of self motivation-Motivation & goal setting – Motivation and emotion – Motivation at work.

Total: 30 Hours

COURSE OUTCOMES:

CO1: Develop the soft skills through personality features and get rid of barriers.
CO2: Build the basic characters such as cleanliness, hygiene and appearance.
CO3: Creating the soft skills in disciplinary actions.
CO4: Understand the concept of self-awareness and self esteem
CO5: Adapt Familiar with the self-motivation

REFERENCES:

1. Personality Development And Soft Skills---Barun K Mitra, Oxford Publication
2. Seven habits of Higly Effective people – Stephen R. covey
3. Emotion, motivation and Self regulation - Nathan C. Hall , McGill University, Canada, Thomas Goetz, University of Konstanz, Germany
4. http://www.emeraldgrouppublishing.com/
5. Psychology of Self esteem – Nathaniel Branden, Nash (1st edition), Jossey-Bass (32nd anniversary edition

18HSPE41 PERSONALITY DEVELOPMENT II 2 0 0 2

COURSE OBJECTIVE:

- To improve the leadership quality, team management, quantitative analyzing knowledge, ordering, sequencing and logical thinking knowledge to meet their professional career.

UNIT I SOFT SKILLS III 6

Basic Etiquette – Email etiquette – Business etiquette – Telephone etiquette – Meeting etiquette – Adjustment of Role & Leadership – Team Management & Development

UNIT II QUANTITATIVE APTITUDE I 6

Percentage – Profit Loss -Discount – Ratio Proportion – Time & Work – Time, Speed & Distancel. Problems relating to ages- Permutation &Combination-Probability

UNIT III QUANTITATIVE APTITUDE II 6

Mensuration Clocks and Calendars- Boats-Simple Interest –Compound Interest- Fractions and Decimals – Square roots – Functions.

UNIT IV ANALYTICAL PROBLEMS 6

Introduction – Linear Sequencing – Seating Arrangements – Distribution/Double Line Up – Selection – Ordering and Sequencing – Binary Logic – Venn Diagrams –Directions.

UNIT V LOGICAL PROBLEMS 6

Introduction to Logical problems – Cause and Effect – Course of Action – Statement and Assumption – Letter and Symbol series – Analogies.

TOTAL: 30 Hours

COURSE OUTCOMES:

CO1: Develop the soft skills and basic etiquette
CO2: Develop the quantitative aptitude skills
CO3: Build the advanced aptitude skills
CO4: Adapt Familiar with the analytical problem-solving skills
CO5: Build the knowledge on logical problem-solving skills

REFERENCES:

1. Personality Enrichment--K R Dhanalakshmi And N S Raghunathan, Margham Publications
2. Personality Development --Dr V M Selvaraj Bhavani Publications
3. Quantitative Aptitude – R. S Aggarwal
4. Logical and Analytical Reasoning (English) 30th Edition – A.K Gupta

18HSPE51 PERSONALITY DEVELOPMENT III 2 0 0 2

COURSE OBJECTIVE:

- To improve the verbal aptitude, Speech Mechanism, Sentence Stress knowledge, Personality factors, time management and team building to meet their professional career.

UNIT I VERBAL APPTITUDE I 6

Phonetics/Neutral Accent/Pronunciation – Speech Mechanism/Mouth & Face Exercise – Vowels & Consonants
– Sounds – Syllable and Syllable Stress/ Word Stress – Sentence Stress & Intonation – Articulation Exercise – Rate of Speech / Flow of Speech / Idiomatic Phrases.

UNIT II VERBAL APTITUDE II 6

Singular/plural-present tense/past tense—genders - Prepositions-conjunctions-Choice of words—simple sentences—compound sentences- summarising phrases—Synonyms—Antonyms—Analogies—Similar Words

UNIT III SOFT SKILLS IV 6

Attitude—Meaning- Features of attitude-Formation-Personality Factors-Types of attitude-change in attitude- Developing Positive attitude.

UNIT IV TIME MANAGEMENT 6

Definition –Meaning-Importance, Value of time as an important resource- comparison of Time and Money- Circle of influence and circle of control—Definition of URGENT and IMPORTANT—Time Wasters and how to reduce—Procrastination—meaning and impact- 4 Quadrants.

UNIT V TEAM BUILDING 6

Meaning—Aspects of team building—Process of team building—Types of Teams-Team ethics and Understanding-Team trust and commitment

TOTAL: 30 Hours

COURSE OUTCOMES:

CO1: Develop the personality skills
CO2: Build the confidence level
CO3: Evaluate the student's skulls through SWOT analysis
CO4: Develop the self-awareness and self esteem
CO5: Improve the motivation skills

REFERENCES:

1. Managing Soft Skills And Personality - B N Ghosh, Mcgraw Hill Publications.
2. Principles and Practices of Management - Shejwalkar and Ghanekar McGraw Hill Latest.
3. Time management for Busy people – Roberta roesch, Tata Mcgraw-Hill Edition.
4. Personality Development -Dr V M Selvaraj, Bhavani Publications.

18HSPE61 PERSONALITY DEVELOPMENT IV 2 0 0 2

COURSE OBJECTIVE

- To improve the communication by understanding the elements of communication, presentation skills, understanding the audience, Personality factors, improve the skill in seminars and conferences presentation.

UNIT I SOFT SKILLS V **6**

Assertiveness—Meaning—Importance of assertiveness- Characteristics of assertive communication-Merits – forms of assertion—Causes of misunderstanding

UNIT II COMMUNICATION SKILLS **6**

Meaning—Elements of communication—Functions of communication—Principles of communication—Formal and Informal communication—Barriers in Communication—Characteristics of good communication— Feedback—communication systems.

UNIT III PRESENTATION SKILLS I **6**

Meaning—Importance of Presentation—Concept of 5 w's and one H —understanding the audience—Types of presentations—How to make effective presentation

UNIT IV PRESENTATION SKILLS II **6**

Use of slide, PPT's. and visuals—Rules for slide presentation—precautions-seminars and conferences-Steps to eliminate Stage fear.

UNIT V CHANGE MANAGEMENT **6**

Definition – Necessity - Resistance towards Change – 10 Principles of Change Management – Leaders approach - Effective Change management.

TOTAL: 30 Hours

COURSE OUTCOMES:

CO1: Define importance of assertiveness characteristic causes of misunderstanding
CO2: Explain the elements of communication function and principles formal and informal communication
CO3: Classify the importance of presentation and concept of 5w's and One H
CO4: Explain the rules for slide presentation precaution of seminar and conferences
CO5: Define necessity, principles of change management and leader approach

REFERENCES

1. Helping employees embrace change - LaClair, J. and Rao, R. Helping Employees Embrace Change, McKinsey Quarterly, 2002, Number 4.
2. Who Moved My Cheese by Spencer Johnson published by Vermilion first edition
3. Effective Communication. Adair, John. London: Pan Macmillan Ltd., 2003.
4. Business Communication Today: Bovee, Courtland L, John V. Thill & Barbara E. Schatzman.Tenth Edition. New Jersey: Prentice Hall, 2010.

18HSPE11 **NSS I** **2 0 0 2**

UNIT I INTRODUCTION AND BASIC CONCEPTS OF NSS 6

NSS: History, philosophy, aims, objectives –Emblem: flag, motto, song, badge- NSS functionaries: Organizational structure, roles and responsibilities.

UNIT II NSS PROGRAMS AND ACTIVITIES 6

Concept of regular activities- special camping-day camps-Basis of adoption of village/slums, Methodology of conducting survey-Financial pattern of the scheme- other youth program/schemes of GOI- Coordination with different agencies- Maintenance of the dairy

UNIT III UNDERSTANDING YOUTH 6

Youth: Definition, profile of youth, categories – youth: Issues, challenges and opportunities - Youth as an agent of social change.

UNIT IV COMMUNITY MOBILIZATION 6

Mapping of community stakeholders-Designing the message in the context of the problem and the culture of the community-Identifying methods of mobilization-Youth adult partnership

UNIT V VOLUNTEERISM AND SHRAMDAN 6

Indian Tradition of volunteerism-Needs& Importance of volunteerism- Motivation and constraints of volunteerism-Shramdan as a part of volunteerism.

TOTAL: 30 Hours

COURSE OUTCOMES:

CO1: Understand themselves in relation to their community and develop among themselves since of social and civic and responsibility.

CO2: Identify the needs and problem of the community an involve them in problem solving.

CO3: Utilize their knowledge in finding practical solution to individual and community problem.

CO4: Develop the confidence require for group living and sharing of responsibilities of acquire leader ship qualities and democratic attitudes.

CO5: Develop the capacity to meet emergencies and natural disasters and practice national integration and social harmony