ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R - 2013

B. TECH. PETROLEUM ENGINEERING

PROGRAMME OBJECTIVES:

Department's educational objectives state the general goals of the program. Department's graduates are expected to:

- Meet the world's ever-increasing demand for hydrocarbon fuel, thermal energy, and waste and pollution management.
- Be motivated to continuously develop their knowledge and skills.
- Contribute to society

PROGRAMME OUTCOMES:

- Ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct experiments, as well as to analyze and interpret data
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- An ability to identify, formulate, and solve engineering problems related to petroleum industry.
- An understanding of professional and ethical responsibility.
- A recognition of the need for, and an ability to engage in life-long learning.

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B. TECH. PETROLEUM ENGINEERING

I – VIII SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER - I

CODE	COURSE TITLE	L	T	P	C
THEORY					
HS6151	Technical English - I	3	1	0	4
MA6151	Mathematics – I	3	1	0	4
PH6151	Engineering Physics – I	3	0	0	3
CY6151	Engineering Chemistry – I	3	0	0	3
GE6151	Computer Programming	3	0	0	3
GE6152	Engineering Graphics	2	0	3	4
PRACTICAL					
GE6161	Computer Practices Laboratory	0	0	3	2
GE6162	Engineering Practices Laboratory	0	0	3	2
GE6163	Physics and Chemistry Laboratory - I	0	0	2	1
	TOTAL	**17**	**2**	**11**	**26**

SEMESTER – II

CODE	COURSE TITLE	L	T	P	C
THEORY					
HS6251	Technical English - II	3	1	0	4
MA6251	Mathematics - II	3	1	0	4
PH6251	Engineering Physics - II	3	0	0	3
CY6251	Engineering Chemistry - II	3	0	0	3
GE6252	Basic Electrical and Electronics Engineering	4	0	0	4
GE6253	Engineering Mechanics	3	1	0	4
PRACTICAL					
GE6261	Computer Aided Drafting and Modeling Laboratory	0	1	2	2
GE6262	Physics and Chemistry Laboratory - II	0	0	2	1
GE6263	Computer Programming Laboratory	0	1	2	2
		19	**5**	**6**	**27**

SEMESTER – III

CODE	COURSE TITLE	L	T	P	C
THEORY					
MA6351	Transforms and Partial Differential Equations	3	1	0	4
PE6301	Process Engineering Calculations	3	1	0	4
PE6302	Geophysics-I	3	0	0	3
PE6303	Fluid Mechanics	3	0	0	3
CH6361	Heat Transfer	3	0	0	3
PE6304	Engineering Thermodynamics	3	0	0	3
PRACTICALS					
PE6311	Fluid Mechanics Laboratory	0	0	3	2
CH6368	Heat Transfer Laboratory	0	0	3	2
	TOTAL	**18**	**2**	**6**	**24**

SEMESTER – IV

CODE	COURSE TITLE	L	T	P	C
THEORY					
MA6468	Probability and Statistics	3	1	0	4
CH6454	Mass Transfer	3	0	0	3
PE6401	Reservoir Rocks and Fluid Properties	3	0	0	3
PE6402	Fundamentals of Petroleum Geology	3	0	0	3
PE6403	Geophysics –II	3	0	0	3
PE6404	Reservoir Engineering -1	3	0	0	3
PRACTICALS					
PE6411	Petroleum Testing Lab	0	0	3	2
CH6	Mass Transfer Laboratory	0	0	3	2
	TOTAL	**18**	**1**	**6**	**23**

SEMESTER – V

CODE	COURSE TITLE	L	T	P	C
THEORY					
PE6501	Well Drillling Equipments and Operation	3	0	0	3
PE6502	Well Logging	3	0	0	3
PE6503	Drilling fluids and Cementing Techniques	3	0	0	3
PE6504	Field Development Geology	3	0	0	3
PE6505	Reservoir Engineering – II	3	0	0	3
GE6351	Environmental Science and Engineering	3	0	0	3
PRACTICALS					
GE6563	Communication Skills - Laboratory Based	0	0	4	2
PE6511	Geology Laboratory	0	0	3	2
PE6512	Drilling fluids and Cementing Techniques Laboratory	0	0	3	2
	TOTAL	**18**	**0**	**10**	**24**

SEMESTER – VI

CODE	COURSE TITLE	L	T	P	C
THEORY					
PE6601	Reservoir Characterization and Modeling	3	0	0	3
PE6602	Petroleum Production Engineering	3	0	0	3
PE6603	Well Completion Testing and Work over	3	0	0	3
PE6604	Process Control and Instrumentation	3	0	0	3
PE6605	Petroleum Refining and Petrochemicals	3	0	0	3
PE6606	Natural Gas Engineering	3	0	0	3
PRACTICALS					
PE6611	Petroleum Transportation Design	0	0	3	2
PE6612	Process Control and Instrumentation Laboratory	0	0	3	2
	TOTAL	**18**	**0**	**6**	**22**

SEMESTER – VII

CODE	COURSE TITLE	L	T	P	C
THEORY					
PE6701	Onshore and Offshore Engineering and Technology	3	0	0	3
PE6702	Integrated Oil/Gas Field Evaluation	3	0	0	3
PE6703	Petroleum Equipment Design	3	0	0	3
PE6704	Numerical Reservoir Simulation	3	0	0	3
PE6705	Water flooding and enhanced oil recovery	3	0	0	3
	Elective –I	3	0	0	3
PRACTICALS					
PE6711	Oil Field Equipment Design Drawing	0	0	3	2
PE6712	Petroleum Equipment Design Drawing	0	0	3	2
	TOTAL	**18**	**0**	**6**	**22**

SEMESTER – VIII

CODE	COURSE TITLE	L	T	P	C
PE6801	Risk Assessment and Safety Engineering	3	0	0	3
	Elective –II	3	0	0	3
	Elective –III	3	0	0	3
PRACTICALS					
PE6811	Project Work	0	0	12	6
	TOTAL	**9**	**0**	**12**	**15**

TOTAL NO OF CREDITS : 183

LIST OF ELECTIVES

B. TECH. PETROLEUM ENGINEERING

ELECTIVE I

CODE	COURSE TITLE	L	T	P	C
PE6001	Marketing Fundamentals	3	0	0	3
PE6002	Refinery Engineering	3	0	0	3
PE6003	Petroleum Transportation Engineering	3	0	0	3
PE6004	Major Hazards Management	3	0	0	3
PE6005	Petroleum Corrosion Technology	3	0	0	3

ELECTIVE II

CODE	COURSE TITLE	L	T	P	C
PE6006	Advanced Topics in Geophysics	3	0	0	3
PE6007	Storage and Transportation of Crude Oil and Natural Gas	3	0	0	3
PE6008	Computer - Aided Process Plant Design	3	0	0	3
PE6009	Advanced Drilling Engineering	3	0	0	3
PE6010	Well Completion and simulation	3	0	0	3
PE6011	Petroleum Economics	3	0	0	3

ELECTIVE – III

CODE	COURSE TITLE	L	T	P	C
PE6012	Biochemical Engineering	3	0	0	3
PE6013	Chemical Kinetics and Reactor Design	3	0	0	3
PE6014	Principles of Geochemistry	3	0	0	3
GE6075	Professional Ethics in Engineering	3	0	0	3
GE6757	Total Quality Management	3	0	0	3

HS6151 **TECHNICAL ENGLISH – I** **L T P C**
3 1 0 4

OBJECTIVES:

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

UNIT I **9+3**

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II **9+3**

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III **9+3**

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV **9+3**

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

UNIT V **9+3**

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

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

OUTCOMES:

Learners should be able to

- speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents

TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

REFERENCES:

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011.
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006.
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

EXTENSIVE Reading (Not for Examination)

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

WEBSITES:

1. http://www.usingenglish.com
2. http://www.uefap.com

TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

EVALUATION PATTERN:

Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

End Semester Examination: 80%

MA6151	**MATHEMATICS – I**	**L T P C**
		3 1 0 4

OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES 9+3

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

UNIT II SEQUENCES AND SERIES 9+3

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 9+3

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V MULTIPLE INTEGRALS 9+3

Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

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

OUTCOMES:

- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

TEXT BOOKS:

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics", Volume I, Second Edition, PEARSON Publishing, 2011.

PH6151 ENGINEERING PHYSICS – I L T P C
3 0 0 3

OBJECTIVES:

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

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity- Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress - strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders

Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel)

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment -Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies.

Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C –scan displays, Medical applications - Sonogram

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO_2, Semiconductor lasers (homojunction & heterojunction)- Industrial and Medical Applications.

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXT BOOKS:

1. Arumugam M. Engineering Physics. Anuradha publishers, 2010
2. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2009
3. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Mani P. Engineering Physics I. Dhanam Publications, 2011
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011
6. Senthilkumar G. Engineering Physics I. VRB Publishers, 2011.

CY6151 ENGINEERING CHEMISTRY - I L T P C
3 0 0 3

OBJECTIVES:

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

UNIT I POLYMER CHEMISTRY 9

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

UNIT II CHEMICAL THERMODYNAMICS 9

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

UNIT IV PHASE RULE AND ALLOYS 9

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

UNIT V NANOCHEMISTRY 9

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

TOTAL :45 PERIODS

OUTCOMES:

- The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

TEXT BOOKS:

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

REFERENCES:

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and JayadevSreedhar, "Polymer Science", New Age International P (Ltd.,), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

GE6151 COMPUTER PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

The students should be made to:

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION 8

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS 10

Problem formulation – Problem Solving - Introduction to ' C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV FUNCTIONS AND POINTERS 9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V STRUCTURES AND UNIONS 9

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Design C Programs for problems.
- Write and execute C programs for simple applications.

TEXTBOOKS:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
3. Yashavant P. Kanetkar. " Let Us C", BPB Publications, 2011.

REFERENCES:

1. Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
3. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

GE6152 ENGINEERING GRAPHICS L T P C
2 0 3 4

OBJECTIVES:

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

CONCEPTS AND CONVENTIONS (Not for Examination) 1

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

UNIT I PLANE CURVES AND FREE HAND SKETCHING 5+9

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above

curves, Scales: Construction of Diagonal and Vernier scales.
Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 5+9

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

UNIT III PROJECTION OF SOLIDS 5+9

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

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+9

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

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+9

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

COMPUTER AIDED DRAFTING (Demonstration Only) 3

Introduction to drafting packages and demonstration of their use.

TOTAL : 75 PERIODS

OUTCOMES:

On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

TEXT BOOK:

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.

REFERENCES:

1. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.

4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

Publication of Bureau of Indian Standards:

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

Special points applicable to University Examinations on Engineering Graphics:

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

GE6161 COMPUTER PRACTICES LABORATORY L T P C
0 0 3 2

OBJECTIVES:

The student should be made to:

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

LIST OF EXPERIMENTS:

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL : 45 PERIODS

OUTCOMES:

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

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
Standalone desktops with C compiler 30 Nos.

(or)
Server with C compiler supporting 30 terminals or more.

GE6162 ENGINEERING PRACTICES LABORATORY L T P C
0 0 3 2

OBJECTIVES:

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

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 9

Buildings:

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

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 13

Welding:

(a) Preparation of arc welding of butt joints, lap joints and tee joints.
(b) Gas welding practice

Basic Machining:

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

Sheet Metal Work:

(a) Forming & Bending:

(b) Model making – Trays, funnels, etc.
(c) Different type of joints.

Machine assembly practice:

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

Demonstration on:

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

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 10

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

IV ELECTRONICS ENGINEERING PRACTICE 13

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

OUTCOMES:

- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

REFERENCES:

1. Jeyachandran K., Natarajan S. & Balasubramanian S., “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
2. Jeyapoovan T., Saravanapandian M. & Pranitha S., “Engineering Practices Lab Manual”, Vikas Puplishing House Pvt.Ltd, 2006.
3. Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A. & Sarma P.M.M.S., “Workshop Practice”, Sree Sai Publication, 2002.
5. Kannaiah P. & Narayana K.L., “Manual on Workshop Practice”, Scitech Publications, 1999.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

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

MECHANICAL

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

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

ELECTRONICS

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

GE6163 **PHYSICS AND CHEMISTRY LABORATORY – I** **L T P C**
0 0 2 1

PHYSICS LABORATORY – I

OBJECTIVES:

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

LIST OF EXPERIMENTS

(Any FIVE Experiments)

1. (a) Determination of Wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of Young's modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

OUTCOMES:

- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee's Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster's bridge set up
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY- I

OBJECTIVES:

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

LIST OF EXPERIMENTS

(Any FIVE Experiments)

1 Determination of DO content of water sample by Winkler's method.
2 Determination of chloride content of water sample by argentometric method.
3 Determination of strength of given hydrochloric acid using pH meter.
4 Determination of strength of acids in a mixture using conductivity meter.
5 Estimation of iron content of the water sample using spectrophotometer.
(1,10- phenanthroline / thiocyanate method).

6 Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
7 Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

OUTCOMES:

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

REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J.and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1.	Iodine flask	-	30 Nos
2.	pH meter	-	5 Nos
3.	Conductivity meter	-	5 Nos
4.	Spectrophotometer	-	5 Nos
5.	Ostwald Viscometer	-	10 Nos

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (each 30 Nos.)

HS6251 TECHNICAL ENGLISH II L T P C
3 1 0 4

OBJECTIVES:

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

UNIT I 9+3

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II **9+3**

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

UNIT III **9+3**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

UNIT IV **9+3**

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V **9+3**

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

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

OUTCOMES:

Learners should be able to

- speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

REFERENCES:

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007

EXTENSIVE Reading (Not for Examination)

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

Websites

1. http://www.englishclub.com
2. http://owl.english.purdue.edu

TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

EVALUATION PATTERN:

Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report

- Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual presentations, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- ✓ Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

End Semester Examination: 80%

MA6251 MATHEMATICS – II L T P C
3 1 0 4

OBJECTIVES*:*

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS 9+3

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 9+3

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III LAPLACE TRANSFORM 9+3

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV ANALYTIC FUNCTIONS 9+3

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: $w = z+k$, kz, $1/z$, z^2, e^z and bilinear transformation.

UNIT V COMPLEX INTEGRATION 9+3

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

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

OUTCOMES:

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

TEXT BOOKS:

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd.,2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics" Volume II, Second Edition, PEARSON Publishing, 2011.

PH6251 ENGINEERING PHYSICS – II L T P C
3 0 0 3

OBJECTIVES:

- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications

Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High T_c superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

TOTAL: 45 PERIODS

OUTCOMES:

- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

TEXT BOOKS:

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

REFERENCES:

1. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011
2. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011
3. Mani P. Engineering Physics II. Dhanam Publications, 2011
4. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009

CY6251 ENGINEERING CHEMISTRY - II L T P C
3 0 0 3

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

UNIT I WATER TECHNOLOGY 9

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion)

prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

UNIT II ELECTROCHEMISTRY AND CORROSION 9

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types- chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

UNIT III ENERGY SOURCES 9

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H_2 -O_2 fuel cell- applications.

UNIT IV ENGINEERING MATERIALS 9

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

UNIT V FUELS AND COMBUSTION 9

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal- analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking- octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- explosive range - flue gas analysis (ORSAT Method).

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

1. Vairam S, Kalyani P and SubaRamesh.,“Engineering Chemistry”., Wiley India PvtLtd.,New Delhi., 2011
2. DaraS.S,UmareS.S.“Engineering Chemistry”, S. Chand & Company Ltd., New Delhi , 2010

REFERENCES:

1 Kannan P. and Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

2. AshimaSrivastava and Janhavi N N., “Concepts of Engineering Chemistry”, ACME Learning Private Limited., New Delhi., 2010.
3. RenuBapna and Renu Gupta., “Engineering Chemistry”, Macmillan India Publisher Ltd., 2010.
4 Pahari A and Chauhan B., “Engineering Chemistry”., Firewall Media., New Delhi., 2010

GE6252 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

UNIT I ELECTRICAL CIRCUITS & MEASURMENTS 12

Ohm’s Law – Kirchoff’s Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS 12

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS 12

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 12

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 PERIODS

OUTCOMES:

- ability to identify the electrical components explain the characteristics of electrical machines.
- ability to identify electronics components and use of them to design circuits.

TEXT BOOKS:

1. Mittle N., “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. Sedha R.S., “Applied Electronics”, S. Chand & Co., 2006.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, 2006.
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press 2005.
3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, 1994.
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002.
5. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers, 2003.

GE6253 ENGINEERING MECHANICS L T P C
3 1 0 4

OBJECTIVES:

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

UNIT I BASICS AND STATICS OF PARTICLES 12

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

UNIT II EQUILIBRIUM OF RIGID BODIES 12

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

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

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

UNIT IV DYNAMICS OF PARTICLES 12

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

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

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

TOTAL : 60 PERIODS

OUTCOMES:

- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

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

REFERENCES:

1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.
3. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
4. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
5. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
6. Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi 2008.

GE6261 COMPUTER AIDED DRAFTING AND MODELING LABORATORY L T P C
0 1 2 2

OBJECTIVES:

- To develop skill to use software to create 2D and 3D models.

List of Exercises using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)

7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

TOTAL: 45 PERIODS

OUTCOMES:

- ability to use the software packers for drafting and modeling
- ability to create 2D and 3D models of Engineering Components

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No	Description of Equipment	Quantity
1.	Pentium IV computer or better hardware, with suitable graphics facility	30 No.
2.	Licensed software for Drafting and Modeling.	30 Licenses
3.	Laser Printer or Plotter to print / plot drawings	2 No.

GE6262 PHYSICS AND CHEMISTRY LABORATORY – II L T P C
0 0 2 1

PHYSICS LABORATORY – II

OBJECTIVES:

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

LIST OF EXPERIMENTS
(Any FIVE Experiments)

1. Determination of Young's modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

OUTCOMES:

- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.

(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY - II

OBJECTIVES:

- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

LIST OF EXPERIMENTS
(Any FIVE Experiments)

1 Determination of alkalinity in water sample
2 Determination of total, temporary & permanent hardness of water by EDTA method
3 Estimation of copper content of the given solution by EDTA method
4 Estimation of iron content of the given solution using potentiometer
5 Estimation of sodium present in water using flame photometer
6 Corrosion experiment – weight loss method
7 Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4
8 Determination of CaO in Cement.

TOTAL: 30 PERIODS

OUTCOMES:

- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

REFERENCES:

1. Daniel R. Palleros, “Experimental organic chemistry” John Wiley & Sons, Inc., New York, 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., “Vogel’s Textbook of practical organic chemistry, LBS Singapore ,1994.
3. Jeffery G.H, Bassett J., Mendham J. and Denny R.C., “Vogel’s Text book of quantitative analysis chemical analysis”, ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, McMillan, Madras 1980

- **Laboratory classes on alternate weeks for Physics and Chemistry.**

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1.	Potentiometer	-	5 Nos
2.	Flame photo meter	-	5 Nos
3.	Weighing Balance	-	5 Nos
4.	Conductivity meter	-	5 Nos

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (30 Nos each)

GE6263 COMPUTER PROGRAMMING LABORATORY L T P C
0 1 2 2

OBJECTIVES:

The Students should be made to

- Be exposed to Unix shell commands
- Be familiar with an editor on Unix
- Learn to program in Shell script
- Learn to write C programme for Unix platform

LIST OF EXPERIMENTS

1. UNIX COMMANDS **15**

Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING **15**

Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX **15**

Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students should be able to:

- Use Shell commands
- Design of Implement Unix shell scripts
- Write and execute C programs on Unix

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

- 1 UNIX Clone Server
- 3 3 Nodes (thin client or PCs)
- Printer – 3 Nos.

Software

- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

MA6364 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
3 1 0 4

OBJECTIVES:

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

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 both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 9 + 3

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

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV FOURIER TRANSFORMS 9 + 3

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9 + 3

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

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

OUTCOMES:

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOKS:

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

REFERENCES:

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd , 2007.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company Limited, NewDelhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

PE6301 PROCESS ENGINEERING CALCULATIONS L T P C
3 1 0 4

OBJECTIVE:

To teach concept of degree of freedom and its application to solution of mass and energy balance equations for single and network of units and introduce to process simulators.

UNIT I **9**

Methods of expressing compositions of mixture and solutions, wet and dry basis conept. Ideal and real gas laws – Gas constant – normal molal volume, calculations of pressure, volume and temperature using ideal gas law. Gas mixtures – Use of partial pressure and pure component volume in gas calculations – Dissociating gases – applications of real gas relationships in gas calculation.Gas Reservoir calculation of gas in place by volumetric method. Calculation of unit recovery from volumetric gas reservoirs. Calculation of unit recovery from Gas Reservoir under water drive.

UNIT II **9**

Concept of material balance : Application of material balance to unit operations like distillation, evaporation, drying. Material balance involving key components, material balance with chemical reaction, - Limiting and excess reactants – Degree of completion. Application of material balance to various types of chemical reactions – recycle and by passing operations – concept of purge. Material balance equations for dry gas reservoirs. Material balance for solution – gas drive reservoirs.

UNIT III **9**

Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity – Dew point – Use of humidity in condensation and drying – Wet and dry bulb temperatures, Humidity chart, solving problems using humidity chart. Calculation of orsat analysis of products of combustion of solid, liquid and gas fuels – Calculation of hydrogen to carbon ratio and percentage excess air from flue gas analysis, calculations of sulphur and sulphur compounds burning operations.

UNIT IV **9**

Heat capacity of solids, liquids, gases – mean heat capacity – calculation of sensible heat using heat capacity, Kopp's rule, various types of latent heats. Energy balances – enthalpy data including steam tables and psychrometric charts, heat capacity data, phase change, mixing, heat of solutions, enthalpy – concentration diagram, heats of formation. Combustion and reaction.

UNIT V **9**

Integrated material and energy balance equation. Concept of unsteady state material and energy balances, problems on unsteady state material and energy balances. Calculations of material balance of gas reservoir in different regions with variation in composition.

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

OUTCOME:

Upon completion of this course, the student will know chemical engineering calculations, establishing mathematical methodologies for the computation of material balances, energy balances and overview of industrial chemical processes

TEXT BOOKS:

1. Batt, B.L Vora, S.M. "Sloichiometry" 3rd Edition, Tata Mc.Graw – Hill (1996).
2. Himmelblau, D.M. "Basic Principles of Calculations in Chemical Engineering" EEE, Sixth Edition, Prentice Hall Inc. 2003.

3. Felder, R.M. and Rousseau, R.W "Elementary Principles of Chemical Processes", 3rd Edition, John Wiley & Sons, New York, 2000.

REFERENCES:

1. Houghen O.A, Watson K.M. and Ragatz R.A, "Chemical Process Principles" Part I, CBS Publishers (1973).
2. Warren K.Lewis, Arthur.M, Radash & H.Clay Lewis, "Industrial Stoichiometry, Mc.Graw Hill Book Co., New York, 1995.
3. William C.Lyons, Gary J.Plisga "Standard Handbook of Petroleum and Natural Gas Engineering" Second Edition, Gulf publishing Co., New York 2005.
4. 3. Venkatramani. V, Anatharaman. N and Meera Shariffa Begam " Process Calculations" Printice Hall of India, New Delhi, 2011.
5. 4. . K.V.Narayanan,B.Lakshmipathy,"Stochiometry and Process Calculation", PHI Learning Ltd.(2013).

PE6302 GEOPHYSICS - I L T P C
3 0 0 3

OBJECTIVE:

To impart knowledge on the Earth as a planet and its internal structure, geomagnetism, paleo-magnetism, geothermal and electrical properties.

UNIT I **9**

The earth as a planet and internal structure. Principles of measurements and measurement of earth. Position location techniques on earth's surface. Geodynamics. Plate tectonics, its mechanics and continental margins.

UNIT II **9**

Gravitational force and gravity measurement methods. Accuracy and correction of gravity date. Gravity anomalies and their interpretation. Magnetic field and paleomagnetism. Magnetic surveys, anomalies and interpretation.

UNIT III **9**

Heat generation, flow, Distribution and measurement. Geothermal exploration and temperature logging. Electrical properties of rocks. Electrical survey methods. Elecgtromagnetic methods.

UNIT IV **9**

Earthquakes, history, observation, nomenclature. Study of body and surface waves and prediction of earthquakes. Seismic waves reflection and refraction and their use in data acquisition. Geometry of Seismic waves, wave theory, diffractions and velocities. Tsunamis.

UNIT V **9**

Land operations. Marine methods. 3D exploration. Non-conventional methods – VSP, Shear waves, channel waves. Seismic data processing. Attribute analsis and Migration techniques.

TOTAL : 45 PERIODS

OUTCOME:

Students develop a sound knowledge on Seismology, Seismic survey techniques for oil and gas exploration.

TEXT BOOKS:

1. Principles of applied geophysics by D.S.Parasnis.
2. Geophysical methods by Robert E.Sherief.

REFERENCE:

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

PE6303	FLUID MECHANICS	L T P C
		3 0 0 3

OBJECTIVE:

To impart to the students knowledge on fluid properties, fluid statics, dynamic characteristics for through pipes and porous medium, flow measurement and fluid machineries

UNIT I **9**

The concept of fluid, the fluid as a continuum physical and thermodynamic properties – basic laws – Newtorian and non-newtorian fluids – flow patterns – Velocity field – streamlines and stream tubes – vorticity and irrotationality. The principle of dimensional hormogeneity – dimensional analysis, the Pi-theorems. Similitude – use of dimensional analysis for scale up studies.

UNIT II **9**

Pressure and Pressure gradient – equilibrium of fluid element – hydrostatic pressure distributions – application to manometry – mass, energy and momentum balances – continuity equation, equation of motion, Navier – stokes equation and Bernoullis theorem.

UNIT III **9**

Reynold's number regimes, flow through pipes – head loss, friction factor, minor losses in pipe systems and multiple pipe systems – boundary layer concepts, drag forces on solid particles in fluids – flow through fixed and fluidized beds.

UNIT IV **9**

Constant and variable head meters – pipes, fittings and valves, classification of pumps – performance, curves – compressors and its efficiency. Introduction to compressible flow, comparison of adiabatic and isothermal flow of gases.

UNIT V **9**

Fluid dynamics in Porous Media – Hydrostatic pressure and geothermal gradients. Porosity – permeability relationships and rock microstructure. Diffusivity equation steady state, pseudo-steady state and transfer flow Radial flow and well models. Skin, partial penetration and well productivity index. Horizontal wells. Gas flow and Klinkenberg effect.

TOTAL : 45 PERIODS

OUTCOME:

On completion of this course, the students would have knowledge on

- Fluid properties, their characteristics while static and during flow through ducts, pipes and porous medium.
- Several machineries used to transport the fluid and their performance.

TEXT BOOKS:

1. Neol de Nevers, "Fluid Mechanics for Chemical Engineers." II Edition, 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.Cabe W.L.Smith, J.C and Harriot..P "Unit operations in Chemical Engineering", Mc.Graw Hill, V Edition, 2001.

REFERENCES:

1. White F.M., “Fluid Mechanics”, IV Edition, Mc.Graw – Hill Inc. 1999.
2. Darby, R. “Chemical Engineering Fluid Mechanics” Marcel Decker, 1998.

CH6361 HEAT TRANSFER L T P C
3 0 0 3

OBJECTIVE:

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

UNIT I 9

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

UNIT II 9

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

UNIT III 9

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

UNIT IV 9

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

UNIT V 9

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

TOTAL : 45 PERIODS

OUTCOME:

Students gain knowledge in various heat transfer methodology in process engineering and to design heat transfer equipments such as furnace, boilers and heat exchangers

TEXT BOOKS:

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

REFERENCES:

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

PE6304 ENGINEERING THERMODYNAMICS L T P C
3 0 0 3

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

UNIT I ZEROTH AND FIRST LAWS, PROPERTIES OF PURE SUBSTANCES 9
Definitions and Concepts. Property, Thermodynamic State. Equilibrium, Energy, Work. Zeroth Law of Thermodynamics, Temperature Scale. Pure substance, Phase, Simple compressible substance, Ideal gas Equation of State, Law of corresponding states, Compressibility chart, Pressure –Volume and Temperature-volume Phase diagrams. Mollier diagram. First Law of Thermodynamics and its consequences.

UNIT II APPLICATION OF I LAW TO STEADY - STATE PROCESSES, II LAW 9
Application of I Law of Thermodynamics for Flow Process. Steady-state processes. II Law of Thermodynamics and its Applications: Limitations of the I Law of Thermodynamics, Heat Engine, Heat Pump/Refrigerator. II Law of Thermodynamics – Kelvin Planck and Clausius statements. Reversible and irreversible processes, Criterion of reversibility, Carnot cycle and Carnot principles, Thermodynamic Temperature scale, Clausius inequality, Entropy.

UNIT III POWER CYCLES, THERMODYNAMIC POTENTIALS, EQUILIBRIA AND STABILITY 9
Power and Refrigeration Cycles. Thermodynamic Potentials. Maxwell relations. Thermodynamic relations. Equilibria and stability. Maxwell construction, Gibbs Phase Rule. Clapeyron equation and vapor pressure correlations.

UNIT IV PROPERTIES OF PURE COMPONENTS AND MIXTURES 9
Pure component properties: Equation of state. Ideal gas heat capacities, fundamental equations from experimental data, fugacity and corresponding states. Mixture Properties: Mixing function. Gibbs-Duhem relation for mixtures, partial molar quantities. Ideal gas mixtures and fugacities, ideal mixtures and activities, excess functions. Gibbs free energy models, infinite dilution properties. Henry's Law

UNIT V PHASE EQUILIBRIA AND CHEMICAL REACTION EQUILIBRIA 9
Phase Equilibira of Mixtures. Osmotic pressure and Osmotic coefficients. Boiling point elevation and freezing point depression. Chemical Reaction Equilibria. Reaction extent and Independent reactions. Equilibrium criteria and equilibrium constant. Standard enthalpies and Gibbs free energy, temperature and pressure effects on reactions, heterogeneous reaction, multiple chemical reactions

TOTAL : 45 PERIODS

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

TEXT BOOKS:

1. Sonntag, Borgnakke, Van Wylen, Fundamentals of Thermodynamics, 7th Edition, Wiley India, New Delhi, 2009.
2. Smith, van Ness and Abbott, "Chemical Engineering Thermodynamics", 7th Edition, McGraw Hill, New York, 2005

REFERENCES:

1. S. I. Sandler, Chemical, Biochemical and Engineering Thermodynamics, Wiley New York, 2006

2. Y V C Rao, “Chemical Engineering Thermodynamics”, Universities Press, Hyderabad 2005.
3. K.V.Narayanan,”Chemical Engineering Thermodynamics”,2nd Edn,PHI Learning Ltd (2013).
4. Pradeep ahuja,” Chemical Engineering Thermodynamics”, PHI Learning Ltd (2009).
5. Gopinath Halder,” Introduction to Chemical Engineering Thermodynamics”, PHI Learning Ltd (2009).

PE6311 FLUID MECHANICS LABORATORY L T P C
0 0 3 2

OBJECTIVE:
To enable the students to learn experimentally to calibrate flow meters, find pressure loss for fluid flows and determine pump characteristics.

LIST OF EXPERIMENTS
1. Calibration of constant and variable head meters
2. Calibration of weirs and notches
3. Determination of drag coefficient
4. Flow through straight pipe
5. Flow through annular pipe
6. Pressure drop studies in packed column
7. Minimum fluidization velocity in gas-solid and liquid -solid fluidization column
8. Open drum orifice and draining time
9. Flow through helical coil and spiral coil
10. Characteristic curves of pumps
11. Losses in pipe fittings and valves
12. Viscosity measurement of non Newtonian fluids.

TOTAL : 45 PERIODS

OUTCOME:
The student would have practical knowledge on the measurement of fluid flow and their characteristics at different operating conditions.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS
1. Viscometer
2. Venturi meter
3. Orifice meter
4. Rotameter
5. Weir
6. Open drum with orifice
7. Pipes and fittings
8. Helical and spiral coils
9. Centrifugal pump
10. Packed column
11. Fluidized bed

CH6368 HEAT TRANSFER LABORATORY L T P C
0 0 3 2

OBJECTIVE:
To train the students on different types of heat transfer equipments.

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

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

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS
1. Cooling Tower
2. Tray Dryer
3. Open Pan Evaporator
4. Boiler
5. Packed Bed
6. Double Pipe Heat Exchanger
7. Bare and Finned Tube Heat Exchanger
8. Condenser
9. Helical Coil
10. Agitated Vessel

TOTAL : 45 PERIODS

MA6468 PROBABILITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:
- This course aims at providing the required skill to apply the statistical tools in engineering problems.

UNIT I RANDOM VARIABLES 9 + 3
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 9 + 3
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 9 + 3

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

UNIT IV DESIGN OF EXPERIMENTS 9 + 3

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

UNIT V STATISTICAL QUALITY CONTROL 9 + 3

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

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

OUTCOMES:

- The students will have a fundamental knowledge of the concepts of probability. Have knowledge of standard distributions which can describe real life phenomenon. Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS:

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2. Johnson. R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.
3. Papoulis. A and Unnikrishnapillai. S., "Probability, Random Variables and Stochastic Processes " Mc Graw Hill Education India , 4th Edition, New Delhi , 2010.

REFERENCES:

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th Edition, 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

CH6454 MASS TRANSFER L T P C
3 0 0 3

OBJECTIVE:

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

UNIT I ABSORPTION 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, vapor-liquid equilibrium diagrams for ideal and non-ideal systems, enthalpy concentration diagrams. Principle of distillation - flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by Mc.Cabe - Thiele method and Ponchan - Savarit method, Total reflux, minimum reflux ratio, optimum reflux ratio. Introduction to multi-component distillation, azeotropic and extractive distillation

UNIT III LIQUID-LIQUID EXTRACTION 9

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

UNIT IV LEACHING 9

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

UNIT V ADSORPTION AND ION EXCHANGE & MEMBRANE SEPARATION PROCESS 9

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

TOTAL : 45 PERIODS

OUTCOME:

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

TEXT BOOKS:

1. Wankat, P., "Equilibrium Stage Separations", Prentice Hall, 1993.
2. Treybal, R.E., "Mass Transfer Operations ", 3rd Edn., McGraw-Hill, 1981.
3. Geankoplis, C.J., "Transport Processes and Unit Operations", 4th Edition, Prentice Hall Inc., New Jersey, 2003.

REFERENCES:

1. Seader, J.D. and E.J. Henley, "Separation Process Principles", 2nd Ed., John Wiley,2006.
2. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edn., McGraw-Hill, 2005.
3. King, C. J., "Separation Processes ", 2nd Edn.,Tata McGraw-Hill 1980.

PE6401 RESERVOIR ROCKS AND FLUID PROPERTIES L T P C
3 0 0 3

OBJECTIVE:
To enable the students to understand
- Petroleum reservoir system and fluid properties
- Basic principles and operations in upstream petroleum industry

UNIT I **9**
The earth, crust, plate tectonics and geologic times. Sedimentary geology, Basins and Margins. Origin, accumulation and migration of petroleum. Properties of subsurface fluids. Petroleum Chemistry.

UNIT II **9**
Porosity and Permeability relationship – Porosity. Permeability. Porosity – Permeability relationship. Electrical properties of rocks. Measurement of formation resistivity. Correlation of FR with porosity, permeability and water saturation. FR of Shaley Reservoir rocks. Effect of stree on porous rocks. Formation evaluation.

UNIT III **9**
Capillary Pressure and Wellability – Fluid Satuaration and Capacity pressure. Determination of capillary pressure. Pore size distribution. Wettability. Evaluation of wettability and its effect on oil recovery. Alteration of wettability. Effect of wettability on electrical properties of rocks.

UNIT IV **9**
Linear flow of incompressible fluids. Darcy's Law. Linear flow of gas. Darcy's and Poiseuille's laws. Various flow systems. Multiple permeability rocks.

UNIT V **9**
Reservoir fluid properties – Phase behaviour of hydrocarbon system. Fluid rock interactions. Reservoir fluid characteristics. PVT analysis. Flash liberation and differential liberation study.

TOTAL : 45 PERIODS

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

TEXT BOOKS:
1. Craft, B.C. and Hawkins M.F. "Applied Petroleum Reservoir Engineering" second edition, Prentice-Hall (1991)
2. Djebbar Tiab : "Theory and pratice of measuring Reservoir rock and fluid Transport properties

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

PE6402 FUNDAMENTALS OF PETROLEUM GEOLOGY L T P C
3 0 0 3

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

UNIT I **9**
Introduction to earth science - Origin of earth. Nature and properties of minerals and rocks. Sedimentation and sedimentary environment. Stratigraphy and geological time scale. Introduction of plate tectonics.

UNIT II **9**
Sedimentalogy of Petroleum bearing sequences - Sedimentary basins. Generation and Migration of Petroleum. Physical and Chemical properties of Petroleum.

UNIT III **9**
Subsurface Environment – Formation fluids – Composition, temperature, pressure and dynamics. Traps and Seals. The Reservoir. Generation and Migration and Distribution.

UNIT IV **9**
Exploration Methods - Well drilling. Formation Evaluation. Geophysical. Borehole Seismic and 4D Seismic. Subsurface geology.

UNIT V **9**
Non conventional petroleum resources and reserve estimation. – Plastic and solid hydrocarbons. Tar sands. Oil and gas shales. Coal bed methane. Assessment of reserves.

TOTAL : 45 PERIODS

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

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

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

PE6403 **GEOPHYSICS-II** **L T P C**
3 0 0 3

OBJECTIVE:
To review the basic geophysical concepts as used in the petroleum industry; applications of seismic data in reservoir description.

UNIT I **9**
Geophysics as a toll for mapping of subsurface geological features – Introduction. Technology implementation. Seismic interpretation. Seismic characteristics and structural features. Pitfalls due to 3D effects and shallow features. Seismic stratigraphy. 3D data acquisition and processing.

UNIT II **9**
Work stations – Introduction. Hardware and Software. Work station capabilities. Display techniques. 3D visualization.

UNIT III **9**
3D Interpretation – Fault recognisation and mapping. Limitations on 2D fault mapping. Advantage of 3D diagram. 3D structural mapping. Stratigraphic interpretation. Analysis of direct hydrocarbon indicators. Summary.

UNIT IV **9**
Seismic attributes - Introduction. Classification of attributes. Reservoir properties, tectonics and fault planes. Lithology, structure and sedimentology. Discussion and conclusions. Dip and azimuth technology.

UNIT V **9**
Reservoir evolution – Reservoir management. Process model. Effect of rock and fluid properties. Flow surveillance and porocity calculations. 4D seismic. Inversion of seismic reflection data applications. 4D reservoir characterization.

TOTAL : 45 PERIODS

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

TEXT BOOKS:
1. S.Boyer & J.J. MARI “Seismic Surveying and Well Logging” – Technip Editions, 2004
2. J.J. MARI & E. COPPENS “Well Seismic Surveying” – Technip Edition 2003

PE6404 RESERVOIR ENGINEERING I L T P C
3 0 0 3

OBJECTIVE:

To enable the students to

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

UNIT I **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 behaviour.

UNIT II **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 **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. Darey Law and application.

UNIT IV **9**

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

UNIT V **9**

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

TOTAL : 45 PERIODS

OUTCOME:

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

TEXT BOOKS:

1. L.P.Dake L Elsevier, “Fundamentals of Reservoir Engineering”, Development in Petroleum Science. 1980
2. Craft B.C and Hawkins M.F. – Applied Petroleum Reservoir Engineering” 2nd Edition. Prentice Hall Englewood Cliffs, N.J., 1991

REFERENCES:

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

PE6411 PETROLEUM TESTING LABORATORY L T P C
0 0 3 2

OBJECTIVE:
On completion of the course, the students should be conversant with the theoretical principles and experimental procedures for quantitative estimation.

LIST OF EXPERIMENTS

1. Aromatioc content Determination
2. Carbon residue determination
3. Karl-Fisher Conductometer Apparatus for water estimation
4. Foaming characteristics of tube oil
5. Mercaptan as sulphur estimation
6. C orrosion testing of petroleum oils and copper
7. Freezing point of Aqueous Engine coolant solution
8. Automatic Vaccuum EDistillation
9. Characteristics of Hydrocarbon types in Petroleum products
10. Coking tendency of oil
11. Saybolt color of petroleum products
12. Water separately of Petroleum products .

TOTAL : 45 PERIODS

OUTCOME:
Students would be able to understand basic principles involved in testing of Petroleum products by different techniques.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

1. Conradson Apparatus	2
2. Karl –Fisher	2
3. Dr. Test Apparatus	2
4. Bomb Calorimeter	2
5. API Distillation Apparatus	2
6. Junkers Gas Calorimeter	2
7. Abbey Refractometer	2
8. Mercaptain as sulphur Estimation Apparatus	2

CH6613 MASS TRANSFER LABORATORY L T P C
0 0 3 2

OBJECTIVE:
To train the students to have sound working knowledge on different types of mass transfer equipments.

LIST OF EXPERIMENTS

1. Separation of binary mixture using Simple distillation
2. Separation of binary mixture using Steam distillation
3. Separation of binary mixture using Packed column distillation
4. Measurement of diffusivity
5. Liquid-liquid extraction
6. Drying characteristics of Vacuum Dryer
7. Drying characteristics of Tray dryer

8. Drying characteristics of Rotary dryer
9. Water purification using ion exchange columns
10. Mass transfer characteristics of Rotating disc contactor
11. Estimation of mass/heat transfer coefficient for cooling tower
12. Demonstration of Gas – Liquid absorption

TOTAL : 45 PERIODS

OUTCOME:
Students will acquire knowledge on the determination of important data for the design and operation of the process equipments like distillation, extraction, diffusivity, drying principles which are having wide applications in various industries

LIST OF EQUIPMENT FOR BATCH 30 STUDENTS
1. Simple distillation setup
2. Steam distillation setup
3. Packed column
4. Liquid-liquid extractor
5. Vacuum Dryer
6. Tray dryer
7. Rotary dryer
8. Ion exchange column
9. Rotating disc contactor
10. Cooling tower
11. Absorption column

Minimum 10 experiments shall be offered.

PE6501 WELL DRILLLING EQUIPMENTS AND OPERATION L T P C
3 0 0 3

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

UNIT I **9**
Drilling operations – Location to Rig. Release Well Bore Diagram, Crews – Operator – Drilling, contractor – Third Party Services – Rig Types – Land Types – Marine types

UNIT II **9**
Components- Overall Drilling Rig, Drilling Sub systems – Power – Hoisting Line – speeds and Loads Power – Loading Components – Drill Pipe, Heavy Weight Drill Pipe (HWDP), Drill String Loads Uniaxial.

UNIT III **9**
Directional Drilling, Well Planning, Two Dimensional, Horizontal, Tools, Techniques, MWD, surveying – Radius of Curvature, Long's Method – Errors, Muds, Mud Use, Property measurements, Types, - Pneumatic (Air, Gas, Mist, Foam), Water based, Oil based, solids Control, Definitions, Equipment, Problems, Contaminations Effect.

UNIT IV **9**

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

UNIT V **9**

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

TOTAL : 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

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

REFERENCE:

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

PE6502 **WELL LOGGING** **L T P C**
3 0 0 3

OBJECTIVE:

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

UNIT I **9**

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

UNIT II **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 **9**

Recording, transmission and processing of log data. Formation evaluation for hydrocarbons. Qualitative and quantitative interpretations of well log data. Overlays and cross-plots. Determination of reservoir parameters – porosity, resistivity, permeability, water and hydrocarbon saturation, movable oil. Lithology determination by neutron, density and sonic

cross-plots, dual mineral method, triporosity method, litho porosity cross-plot (M-N plot), clean sand and shaly sand interpretations.

UNIT IV **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. Determination of groundwater flow direction by logs.

UNIT V **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. Sub-surface correlation of formations and interpretation of field data.

TOTAL : 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

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

REFERENCE:

1. Serra.O 'Fundamentals of Well log Interpretation' Volume1. Elsevier Science Publisher, New York, 1984,ISBN 04441327.

PE6503 DRILLING FLUIDS AND CEMENTING TECHNIQUES **L T P C**
3 0 0 3

OBJECTIVE:

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

UNIT I **9**

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

UNIT II **9**

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

UNIT III **9**

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

UNIT IV **9**

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

UNIT V **9**

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

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the students would have

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

TEXT BOOKS:

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

REFERENCES:

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

PE6504 **FIELD DEVELOPMENT GEOLOGY** **L T P C**
3 0 0 3

OBJECTIVE:

To make the students understand the fundamental concepts, principles and theories of the field development geology.

UNIT I **9**

Structural Elements: Dip and Strata – True dip, Apparent dip, Strike, Measurement of dip and strikes, important for Dip and Strike, - Out crops, Outcrops pattern, topography and Geological Structures, Brunton compass, Clino meter, Global Positioning systems**.**

UNIT II **9**

Identifications of Rocks in the fields, Techniques adopted – Fold, Faults, Joints – definition, Types, Classifications do Geological Importance.

UNIT III **9**

Introduction to Stratigraphy – Geological Time – Scale – Bio – Stratigraphy – Chrono Stratigraphy. Collection of samples, - Sedimentary basins, Lithological arrangements.

UNIT IV **9**

Introduction to micro fossils – types of fossils – Importance of Micro fossils – Applications of Micro fossils in Hydrocarbon explorations**.**

UNIT V **9**

Introduction to Remote Sensing – Aerial Photographs – types of Aerial Photographs – Photo Interpretation elements - Satellite Images – Interpretation using satellite imageries – Applications of Remote Sensing in Hydrocarbon Explorations**.**

TOTAL : 45 PERIODS

OUTCOMES:

Students will be able to

- Produce a field development plan/ design for an energy system
- Understand the application of remote sensing and satellite imaging to petroleum engineering in terms of design and analysis.

TEXT BOOKS:

1. Krishnan, M.S., Geology of India and Burma Badgley, P.C., 1965,
2. Structure and tectonics, Harper and Row Billings, Structural Geology
3. Bhagawan Sahay - Petroleum Exploration and Exploitation Practices Miller,V.C., 1961, Photogeology., McGraw Hill.
4. Sabbins, F.F., 1985, Remote Sensing – Principles and Applications., Freeman.
5. Ray, R.G., 1969, Aerial Photographs in Geologic Interpretations., USGS Prof. Paper 373.

PE6505 **RESERVOIR ENGINEERING - II** **L T P C**
3 0 0 3

OBJECTIVE:

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

UNIT I **9**

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

UNIT II **9**

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

UNIT III **9**

Well testing – Basic well testing theory – oil well testing: gas well testing – Practical well testing – Gas field reservoir engineering – Fluid phase behaviour – Gas in place volumes and recovery estimations. Reservoir testing and performance analysis: well test – drillstem 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 **9**

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

UNIT V **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 draw down and build up analysis.

TOTAL: 45 PERIODS

OUTCOME:

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

TEXT BOOKS:

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

REFERENCE:

1. Craft B.C. and Hawkins M.P. "Applied Petroleum reservoir engineering" 2-nd Edition Prentice hall – 1991.

GE6351 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

To the study of nature and the facts about environment.

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

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 10

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO_2, NO_X, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their

environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies –
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

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

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act –The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides.
Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS:

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

REFERENCES:

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

GE6563 COMMUNICATION SKILLS – LABORATORY BASED L T P C
0 0 4 2

OBJECTIVES:

- To provide opportunities to learners to practice their communicative skills to make them become proficient users of English.
- To enable learners to fine-tune their linguistic skills (LSRW) with the help of technology to communicate globally.
- To enhance the performance of learners at placement interviews and group discussions and other recruitment procedures.

UNIT I LISTENING/VIEWING 10

Listening and note-taking – Listening to telephonic conversations – Ted talks – Inspiring Speeches – Watching documentaries on personalities, places, socio-cultural events, TV news programmes and discussions to answer different kinds questions, viz., identifying key idea and comprehension questions… so on.

UNIT II SPEAKING 12

Conversation practice – Interview – Group Discussion – Introducing oneself and others – Role play – Debate – Presentation – Panel discussion – Neutral accent.

UNIT III READING 10

Different genres of text (literature, media, technical) for comprehension – Reading strategies like note-making – reading graphs, charts and graphic organizer – Sequencing sentences – reading online sources like e-books, e-journals and e-newspapers.

UNIT IV WRITING 12

Blogs – Tweets – Online resume/ – e-mails – SMS and Online texting – Report writing – Describing charts and tables – Writing for media on current events.

UNIT V VOCABULARY 8

Idioms and Phrases – Proverbs – Collocations – Chunks of language.

UNIT VI GRAMMAR 8

Sentence structures – Subject-Verb agreement – Pronoun-Antecedent agreement – Tense forms – Active and passive voices – Direct and Indirect speeches – Cohesive devices.

TOTAL: 60 PERIODS

TEACHING METHODS:

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for graining proficiency and better participation in the class.

Lab Infrastructure:

Sl. No.	Description of Equipment (Minimum configuration)	Qty Required
1	**Server**	1 No.
	• PIV System	
	• 1 GB RAM / 40 GB HDD	
	• OS: Win 2000 server	
	• Audio card with headphones	
	• JRE 1.3	
2	**Client Systems**	60 Nos.
	• PIII System	
	• 256 or 512 MB RAM / 40 GB HDD	
	• OS: Win 2000	
	• Audio card with headphones	
	• JRE 1.3	
3	Handicam	1 No.
4	Television 46”	1 No.
5	Collar mike	1 No.
6	Cordless mike	1 No.
7	Audio Mixer	1 No.
8	DVD recorder/player	1 No.
9	LCD Projector with MP3/CD/DVD provision for Audio/video facility	1 No.

Evaluation:

Internal: 20 marks

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

External: 80 marks

Online Test	- 35 marks
Interview	- 15 marks
Presentation	- 15 marks

Group Discussion - 15 marks

Note on Internal and External Evaluation:

1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking **–** example for role play:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics
4. Discussion – topics of different kinds; general topics, case studies and abstract concept

OUTCOMES:

At the end of the course, learners should be able to

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews**.**

REFERENCES:

1. Barker, A. **Improve Your Communication Skills.** New Delhi: Kogan Page India Pvt. Ltd., 2006.
2. Craven, Miles. **Listening Extra – A resource book of multi-level skills activities**.Cambridge University Press, 2004.
3. Gammidge, Mick. **Speaking Extra - A resource book of multi-level skills activities.** Cambridge University Press, 2004.
4. Hartley, Peter. **Group Communication**. London: Routledge, 2004.
5. John Seely. **The Oxford Guide to Writing and Speaking**. New Delhi: Oxford University Press, 2004.
6. Naterop, Jean & Rod Revell. **Telephoning in English**. Cambridge University Press, 1987.
7. Ramesh, Gopalswamy and Mahadevan Ramesh. **The ACE of Soft Skills**. New Delhi: Pearson, 2010.

PE6511	GEOLOGY LABORATORY	L T P C
		0 0 3 2

OBJECTIVE:

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

LIST OF EXPERIMENTS

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

TOTAL : 45 PERIODS

OUTCOME:

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

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

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

PE6512 DRILLING FLUIDS AND CEMENTING TECHNIQUES LABORATORY L T P C
0 0 3 2

OBJECTIVES:

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

LIST OF EXPERIMENTS

1) Drilling Fluid properties measurements using: Mud balance – Determination on density or weight of a drilling mud.
2) Determination of thickening time of cement slurries using Fann consistomeres.
3) Determination and measurement of fluid loss and mud cake properties of a drilling fluid using a low pressure – Low temperature and High temperature filter and Filter press.
4) Picnometer and F.G.T.. meter
5) pH and resistivity emulsion.
6) Test cell meters.
7) Oil well cement properties; measurement of the compressive strength or tensile strength of the cement at pressure up to 21000 Kpa and maximum temperature of 260 ^{o}C.
8) Measurement and control of the basic properties of drilling fluids (density, viscosity, filtration, lubricity and electrochemical properties) and cement slurries (density, viscosity, filtration, thickening time and mechanical properties).

OUTCOME:

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

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

1) Mud balance
2) Picnometer and F.G.T meter
3) Filter press, low pressure – Low temperature and high temperature filters
4) pH meter
5) Test cell meters
6) Compact Curing chamber
7) Thickening time tester

PE6601 RESERVOIR CHARACTERIZATION AND MODELING L T P C
3 0 0 3

OBJECTIVE:
To enable the students to follow and utilize different concepts of reservoir modeling and characteristics and their usage.

UNIT I **9**
Overview of reservoir characterization and modeling problems. Reservoir mapping. 3D modeling. Univariate, bivariate and multivariate statistics for geological data analysis.

UNIT II **9**
Pattern recognition techniques. Petrophysical predictions from well logs. Introduction to petroleum geostatitsics. Variograms. Kringin. Uncertanity quantification.

UNIT III **9**
Stochastic reservoir modeling. Sequential simulation. Gaussian simulation.Indicator simulation. Integrating seismic attributes, well tests and production data. Constraining reservoir models with various sources of information. Reservoir up girding and upscaling.

UNIT IV **9**
Reservoir simulation – Investigation of petroleum reservoir characteristics and behavior, including: pore volume, fluid distribution and movement, and recovery. 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 V **9**
Pressure transient interpretation. Seismic reservoir charactreisation. Log management, correlation and petrophysical analysis. Geology correlator probe – AVO Reservoir Characterization. Software used in reservoir characterization and modeling.

TOTAL : 45 PERIODS

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

TEXT BOOKS:
1. Petroleum Exploration Hand Book by Moody, G.B.
2. Wellsite Geological Techniques for petroleum Exploration by Shay's et al.

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

PE6602 PETROLEUM PRODUCTION ENGINEERING L T P C
3 0 0 3

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

UNIT I **9**
Components of the petroleum systems. Well productivity engineering. Production from under saturated oil reservoirs. Production from two-phase reservoirs. Production from gas reservoirs. Pseudo critical properties of natural gases. Gas well deliverability for non – Darcy flow.

UNIT II **9**
The near-well bore condition and damage characterization, the effect of perforation conditions on well performance. Well bore flow performance. Well deliverability. Well head surface gathering systems. Artifical lift systems. Horizontal well production. System analysis. Production Chemistry Basics (Wax, Scale, Corrosion, Emulsions).

UNIT III **9**
Surface equipment and operations. Flow control and well heads. Gathering systems; service and cleaning systems; design and testing of flow lines. Separation and separators; separator components, stage separation; design and construction of separators. Meeting - Oil and gas metering techniques.

UNIT IV **9**
Flow measurement system; liquid level controllers. Emulsion problems; oil emulsions; emulsifying agents and de-emulsifiers, choice and dosage of de-emulsifiers, heat treatment, heat treaters, desalting, oil storage and tank farms. Gauging, sampling and quality control. Underground storage – caverns etc. Water disposal, corrosion. Water injection systems. Subsurface equipment**.**

UNIT V **9**
Well completion techniques and equipment, drill stem test (DST) flowing well performance, vertical lift performance, optimum size tubing and chokes, production forecast for a pool. Design and analysis of artificial methods of petroleum production. Work over and sand exclusion technique**.**

TOTAL : 45 PERIODS

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

TEXT BOOKS:

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

REFERENCE:

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

PE6603 WELL COMPLETION TESTING AND WORK OVER L T P C
3 0 0 3

OBJECTIVE:
To provide insights into the Well Operation during the hydrocarbon Explorations.

UNIT I **9**
Well design: Prediction of formation pore pressure and stress gradients. Determination of safety mud weight bounds for different in-situ stress conditions. Design and planning well trajectory. Surveying tools and methods**.**

UNIT II **9**
Design of drill string including bottom hole (BHA) assembly. Drilling methods and equipment for directional, horizontal and multilateral wells. Selection of casing shoes, material properties and design of casing program**.**

UNIT III **9**
Well Completion and Stimulations: Well completion design, types of completion, completion selection and design criteria. Interval selection and productivity considerations: effects of producing mechanisms. Inflow performance and multiple tubing performance analyses using commercial software.

UNIT IV **9**
Well stimulation and workover planning. Tubing-packer movement and forces. Tubing design: graphical tubing design and simplified tensional strength design. Selection of down hole equipment, tubing accessories and wellhead equipment.

UNIT V **9**
Basics of perforation, selection of equipment and procedure for perforation oil and gas wells. Technology of sand control: gravel packing. Fundamentals of well stimulation technologies: acidization and hydraulic fracturing.

TOTAL : 45 PERIODS

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

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

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

PE6604 PROCESS CONTROL AND INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVE:
To introduce open and closed loop systems and its responses, control loop components and stability of control systems along with instrumentation.

UNIT I INSTRUMENTATION 9
Principles of measurements and classification of process instruments, measurement of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity, pH, concentration, electrical and thermal conductivity, humidity of gases.

UNIT II OPEN LOOP SYSTEMS 9
Laplace transformation and its application in process control. First order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag.

UNIT III CLOSED LOOP SYSTEMS 10
Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatory problems, transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transient response of closed-loop control systems and their stability.

UNIT IV FREQUENCY RESPONSE 9
Introduction to frequency response of closed-loop systems, control system design by frequency response techniques, Bode diagram, stability criterion, tuning of controllers Z-N tuning rules, C-C tuning rules.

UNIT V ADVANCED CONTROL SYSTEMS 8
Introduction to advanced control systems, cascade control, feed forward control, Smith predictor, control of distillation towers and heat exchangers, introduction to computer control of chemical processes.

TOTAL : 45 PERIODS

OUTCOMES:
Students will understand and discuss the importance of process control in process operations and the role of process control engineers. They also understand and design the modern hardware and instrumentation needed to implement process control.

TEXT BOOKS:

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

REFERENCES:

1. Marlin, T. E., “ Process Control “, 2nd Edn, McGraw Hill, New York, 2000.
2. Smith, C. A. and Corripio, A. B., “Principles and Practice of Automatic Process Control”, 2nd Edn., John Wiley, New York, 1997.
3. Jason L. Speyer,Walter H.Chung,”Stochastic Processes,Estimation, and Control”,PHI Ltd (2013).

PE6605 PETROLEUM REFINING AND PETROCHEMICALS L T P C
3 0 0 3

OBJECTIVES:

To enable the students to learn the

- Fundamental and methodologies in the petroleum refining processes
- Concepts of petrochemicals, polymerization and the unit operations involved in it.

UNIT I **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 **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 **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 **9**

UNIT PROCESSES Alkylation, oxidation, dehydrogenation, nitration,chlorination, sulphonation and isomerisation.

UNIT V **9**

POLYMERISATION Models and Techniquies, production of polyethylene, PVC, Polypropylene, SAN, ABS, SBR, Polyacrylonitrile, Polycarbonates, Polyurethanes, Nylon, PET

TOTAL : 45 PERIODS

OUTCOME:

Upon completion of this course, the students will understand the unit process involved in the petroleum refining process and polymerization.

TEXT BOOKS:

1. B.K. Bhaskara Rao, “Modern Petroleum Refining Processes” Edition 3, Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.
2. Groggins, “Unit Processing in Organic Synthesis” Edition 5, Tata McGraw Hill 1987

REFERENCES:

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

PE6606 **NATURAL GAS ENGINEERING** **L T P C**
3 0 0 3

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

UNIT I **9**
Natural gas technology and earth science: Branches of petroleum Industry. Sources of Information for natural gas engineering and its applications. Geology and earth sciences: Earth sciences-Historical geology, Sedimentation process, Petroleum reservoirs, Origin of petroleum. Earth temperatures & pressure, Earth temperatures, Earth pressure. Petroleum : Natural gas, LP gas, Condensate, & Crude oil.

UNIT II **9**
Properties of Natural Gases: typical compositions. Equations of state: general cubic equations, specific high accuracy equations. Use of equation of state to find residual energy properties, gas measurement gas hydrates, condensate stabilization, acid gas treating, gas dehydrations, compressors, process control deliverability test, gathering and transmission, and natural gas liquefaction.

UNIT III **9**
Gas Compression: Positive displacement and centrifugal compressors; fans. Calculation of poser requirements. Compressible Flow in Pipes: Fundamental equations of flow: continuity, momentum, elegy equations.

UNIT IV **9**
Isothermal flow in pipes: the Weymouth equation. Static and flowing bottom-hole pressures in wells. Fundamentals of Gas flow in porous media: Steady state flow equations. Definition of pseudo-pressure function. Gas flow in cylindrical reservoirs: general equation for radial flow of gases in symmetrical homogeneous reservoirs.

UNIT V **9**
Non-dimensional forms of the equation; derivation of coefficients relation dimensionless to real variables. Infinite reservoir solution: Pseudo-steady-state solution. Gas Well Deliverability Tests: Flow-after-flow tests: prediction of IPR curve and AOF for the well. Isochronal tests. Draw down tests: need for data at two flow rates.

TOTAL : 45 PERIODS

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

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

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

PE6611 PETROLEUM TRANSPORTATION DESIGN L T P C
0 0 3 2

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

UNIT I FUNDAMENTALS OF DESIGN 9
Steps in design activity. Selection of material. Theories of failure. Stress concentration and factor of safety. Creativity in design activity. Use of standards and codes in design activity. design of shaft, keys and coupling. .

UNIT II DESIGN OF MECHANICAL DRIVE COMPONENTS APPLIED TO PETROLEUM EQUIPMENTS 9
Design of belt drives. Types of pulleys, Design of pulleys (crown & travelling block) Wire ropes-advantages, construction, classification, factor of safety (wire rope sheaves drums), stresses in wire ropes. Classification of chains, power transmitting chains, power calculations. Design consideration for chain and gear drives, Bevel gears. (Rotary system). Power transmission on a rig.

UNIT III PUMPS & COMPRESSOR 9
Selection of pumps and valves. Specification of pumps, valves, performance curve, system pump interaction, two pumps in parallel & series (flow sheet) and compressors – reciprocating ,rotary, centrifugal, reciprocating cylinder sizing. Cooling & lubricating system. Introduction to hydraulic and pneumatic circuit and their components. Introduction to mud circulation system & equipments, Types of springs(compression helical – shale shaker) , Design consideration for pipeline used in oil and gas transportation.

UNIT IV DESIGN OF PRESSURE VESSEL 9
Design of shell. Design of head. Types of sealing materials and gaskets. Design of flanges. Design of nozzles. Classification and Design consideration of separators.

UNIT V DESIGN OF STORAGE SYSTEM 9
Storage of hydrocarbon fluids, Introduction to oil and gas storage facility. Types of storage tank and their design considerations. Design of fixed roof cylindrical storage tank. Liquids, liquefied gases, highly volatile HC, solids, and sulphur containing fluids.

TOTAL : 45 PERIODS

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

TEXT BOOKS:

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

REFERENCES:

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

PE6612 PROCESS CONTROL AND INSTRUMENTATION LABORATORY

L T P C
0 0 3 2

OBJECTIVE:

To determine experimentally, the methods of controlling the processes including measurements using process simulation techniques.

LIST OF EXPERIMENTS

1. Response of first order system
2. Response of second order system
3. Response of Non-Interacting level System
4. Response of Interacting level System
5. Open loop study on a thermal system
6. Closed loop study on a level system
7. Closed loop study on a flow system
8. Closed loop study on a thermal system
9. Tuning of a level system
10. Tuning of a pressure system
11. Tuning of a thermal system
12. Flow co-efficient of control valves
13. Characteristics of different types of control valves
14. Closed loop study on a pressure system
15. Tuning of pressure system
16. Closed loop response of cascade control system

*Minimum 10 experiments shall be ffered.

TOTAL : 45 PERIODS

OUTCOME:

Students gain knowledge on the development and use of right type of control dynamics for process control under different operative conditions.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

i. Rota meter.
ii. Say bolt viscometer.
iii. Redwood viscometer.
iv. Engler viscometer.
v. U tube viscometer.
vi. ph meter.
vii. Dead weight tester.
viii. Pressure Gange.
ix. Conductivity meter.
x. IR spectro photometer.

PE6701 ONSHORE AND OFFSHORE ENGINEERING AND TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:
To enable the students to
- Learn the concepts of petroleum site exploration, analysis of offshore structure
- Understand the offshore soil mechanics.

UNIT I **9**
Introduction to offshore oil and gas operations.. Sea States and Weather, Offshore Fixed and mobile Units, Offshore Drilling, Difference in drilling from land, from fixed platform, jack up, ships and semi submersibles. Offshore Well Completion, Offshore Production systems, Deep-water technology, Divers and Safety, Offshore Environment**.**

UNIT II **9**
Introduction; classification, properties of marine sediments. Consolidation and shear strength characteristics of marine sediments. Planning and site exploration.

UNIT III **9**
Drilling. Sampling techniques. Laboratory testing, In situ testing methods and geophysical methods. Current design practices of pile supported and gravity offshore structures**.**

UNIT IV **9**
Dynamic analysis of offshore structures. Centrifugal modeling. Anchor design. Break out resistance analysis and geotechnical aspects of offshore pipeline and cable design. Field instrumentation and performance observation.

UNIT V **9**
Offshore soil mechanics; Offshore pile foundations and caissons; Design of breakwaters; Buoy design and mooring systems; Offshore drilling systems and types of platforms; Ocean mining and energy systems. ROV. Onshore drilling-on shore oil rigs. onshore drilling equipments-onshore rig structures-hydraulics applied in onshore rigs.

TOTAL : 45 PERIODS

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

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

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

PE6702 INTEGRATED OIL / GAS FIELD EVALUATION L T P C
3 0 0 3

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

UNIT I **9**
Geological studies: - Structural contour maps and various geological models. Estimation of reserves. Hydrodynamic Study, Techno-economic Evaluation for normal and marginal fields. Innovative ways to asset development**.**

UNIT II **9**
Petroleum project evaluation-mineral project evaluation case studies. The design and evaluation of well drilling systems-Economic appraisal methods for oil field developmental project evaluation including risk analysis, probability and statistics in decision-making and evaluations. case studies.

UNIT III **9**
An integrated reservoir description in petroleum engineering-usage of geophysical, geological, 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 : 45 PERIODS

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

TEXT BOOKS:

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

PE6703 **PETROLEUM EQUIPMENT DESIGN** **L T P C**
3 0 0 3

OBJECTIVE:
To study and analyze suitable equipment for particular reservoir conditions.

UNIT I **9**
Casing program, casing and tubing design, principles of cementing, completion added skin, well perforating, hydraulic fracturing. DRILL BIT DESIGN.ROLLER CONE BITS.PDC DRILL BITS.NOMENCLATURE AND IADC CODES for drill bits. BHA (Bottom hole assembly). ESP(Electrical submersible pumps). SRP(Sucker rod pumping) unit design.

UNIT II **9**
Design of Surface Facilities -Design of production and processing equipment, including deparation problems, treating, and transmission systems.

UNIT III **9**
Capstone design Student teams apply knowledge in the areas of geology, reservoir engineering, production, drilling and well completions to practical design problems based on real field data with all of the associated shortcomings and uncertainties. Use of commercial software.

UNIT IV **9**
Oil desalting-horizontal and spherical electrical dehydrators- Natural Gas Dehydration-Horton sphere- Natural Gas Sweetening. Crude & Condensate Stabilization-design of stabilizer- Oil and Gas Treatment. Treating Equipment.

UNIT V **9**
Refinery Equipment Design-atmospheric distillation column Design and construction of on/ offshore pipelines, Fields Problems in pipeline, Hydrates, scaling & wax etc and their mitigation..

TOTAL : 45 PERIODS

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

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

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

PE6704 **NUMERICAL RESERVOIR SIMULATION** **L T P C**
3 0 0 3

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

UNIT I **9**
Introduction, fracturing, Stress Distribution, Vertical Versus Horizontal Fractures, Pressure Related to Fracturing, Closure Pressure, Fracturing Pressure –Decline anlaysis, Pressure Interpretation After Closure, Properties of Fracturing Fluids.

UNIT II **9**
Proppants, Propped Fracture Design, Fracture Propagation Model, Width Equations, Material Balance, Detailed Models. Evaluation of Fracture Design.

UNIT III **9**
Acid Fracturing, Acid Systems and Placement Techniques, Fracturing of Deviated and Horizontal Wells, Matrix Stimulations, Matrix Acidizing Design, Rate and Pressure Limits for Matrix Treatment, Fluid Volume Requirments,

UNIT IV **9**
Design and implementation of a multiphase flow reservoir simulator, including interphase mass transfer and variable fluid saturation pressure. Design of compositional reservoir simulators using generalized equation of state. Recent advances in reservoir simulation.

UNIT V **9**
Overview of simulator models and flow conditions. Methods of Solution. Performance Prediction. History match, concept on coning and compositional models. Stimulation Considerations.

TOTAL : 45 PERIODS

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

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

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

PE6705 WATER FLOODING AND ENHANCED OIL RECOVERY

L	T	P	C
3	0	0	3

OBJECTIVE:

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

UNIT I **9**

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 **9**

Chemical oil recovery methods – Polymer, surfactant/polymer and alkaline flooding – Carbon dioxide (CO_2) flooding.

UNIT III **9**

Thermal recovery – fire flooding – steam flooding – mechanism of hydrocarbon miscible flooding – mechanism of nitrogen and flue gas flooding – mechanism of CO_2 flooding – Mechanism of surfactant/polymer flooding – Mechanism of alkaline flooding – Mechanism of steam flooding.

UNIT IV **9**

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

UNIT V **9**

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

TOTAL : 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

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

REFERENCE:

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

PE6711 OIL FIELD EQUIPMENT DESIGN DRAWING L T P C
0 0 3 2

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

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

TOTAL : 45 PERIODS

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
1. Intel Dual Core computer or better hardware with suitable graphics facility – 30 nos.
2. Licensed siftware for Drafting and Modeling – 30 Licenses.
3. Laser Printer or Plotter to print / Plot drawings – 2 Nos.

PE6712 PETROLEUM EQUIPMENT DESIGN DRAWING L T P C
0 0 3 2

OBJECTIVE:
To train the students to understand the concept of designing Equipments for Petroleum Exploration

LIST OF EXPERIMENTS
1. Design of power transmission component.
2. Design of rotary pump / valve.
3. Design of pressure / reaction vessel.
4. Design of storage tank.
5. Design of heat exchanger.

TOTAL : 45 PERIODS

OUTCOME:
The students will be able to study and analyze suitable equipment for particular reservoir conditions.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

1. Vaccum pump with trap.
2. Rotary film evaporator.
3. Heat exchange.
4. Distillation set.
5. Thin layer Chromatographic set complete with Glass plate, Developer, Tank and UV fluorescent light.

PE6801 RISK ASSESSMENT AND SAFETY ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

To enable the students to

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

UNIT I **9**

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

Hazard identification - Safety Audits - Checklists - What if Analysis – HAZAN – HAZOP - Vulnerability models - Event tree and Fault tree Analysis - Past accident analysis - Flixborough - Mexico - Bhopal - Madras - Vizag accident analysis.

UNIT II **9**

Hazops: Principles - Risk ranking - Guide word - Parameter - Deviation – Causes - Consequences - Recommendation - Coarse HAZOP study - Case studies - Pumping system - Reactor System - Mass transfer system.

UNIT III **9**

Introduction to Consequence Analysis - Fire and Explosion models: Radiation - Tank on fire - Flame length –Risk analysis- Radiation intensity calculation and its effect to plant, people & property, UCVCE -Explosion due to - Deflatration - Detonation - TNT, TNO & DSM model - Over pressure. Methods for determining consequences effects: Effect of fire- Effects of explosion - Risk contour - Flash fire - Jet fire - Pool fire - BLEVE - Fire ball.

UNIT IV **9**

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

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

UNIT V **9**

Risk Management & ISO14000: Overall risk analysis - Generation of Meteorological data - Ignition data - Population data. Overall risk analysis – E and FI model–– Disaster management plan – Emergency planning – Onsite and offsite emergency planning – Risk management – Gas processing complex, refinery – First aids.

TOTAL : 45 PERIODS

OUTCOME:

Students will have learnt the basic concepts relating to chemical hazards, risk, and ethics. They

also gain the knowledge of quantitatively analyze release and dispersion rates of liquids and vapors.

TEXT BOOKS:

1. Blake, R.P., "Industrial Safety", Prentice Hall, 1953.
2. Lees, F.P., "Loss Prevention in Process Industries", 2nd Edition, Butterworth Heinemann, 1996.
3. K. V. Raghavan and A A. Khan, "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.
4. V. C. Marshal, "Major Chemical Hazards", Ellis Horwood Ltd., Chichester, United Kingdom. 1987.

REFERENCES:

1. Geoff Wells, "Hazard Identification and Risk Assessment", I.ChE.,John Ridley and John Channing, "Safety at Work", 6th Edition. Butterworth-Heinemann, 2003.
2. "A Guide to Hazard Operability Studies", Chemical Industry Safety and Health Council, 1977.

PE6001 MARKETING FUNDAMENTALS L T P C
3 0 0 3

OBJECTIVES:

To understand the concepts of marketing process and strategies involved. To understand the importance and role of marketing in a global environment.

UNIT I MARKETING PROCESS 9

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing,organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural, demographic factors, motives, types, buying decisions, segmentation factors demographic -Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TOTAL: 45 PERIODS

OUTCOME:
Students learn the scope and process of marketing. They would be able to learn the importance of ethical marketing practices. They will learn the process of designing effective marketing strategies.

TEXT BOOKS:
1. Govindarajan. M, "Marketing management – concepts, cases, challenges and trends", Prentice hall of India, second edition 2007.
2. Philip Kolter,Koshy Jha "Marketing Management", Pearson Education ,Indian adapted edition.2007

REFERENCES:
1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementationand control the Indian context", 1990.
2. Czinkota&Kotabe, "Marketing management", Thomson learning, Indian edition 2007
3. Adrain palmer, " Introduction to marketing theory and practice", Oxford university press IE 2004.
4. Donald S. Tull and Hawkins, "Marketing Reasearch", Prentice Hall of Inida-1997.
5. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000.
6. Steven J.Skinner, "Marketing", All India Publishers and Distributes Ltd. 1998.
7. Graeme Drummond and John Ensor, Introduction to marketing concepts, Elsevier, Indian Reprint, 2007

PE6002 REFINERY ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
To learn about composition, main characteristics and new trends of petroleum products. To grasp the role of various processing units in a refinery.

UNIT I **9**
Heating of crude oil through exchangers, pipe still heaters, their type and constructional features, Estimation of heat duty, combustion calculation and heat transfer area in different parts in pipe still heater. Calculation of pressure drop and stack height.

UNIT II **9**
Atmospheric distillation, Principles and mode of excess heat removal flash zone calculation and estimation side draw temperatures. Design aspects. Posatmospheric distillation, t treatment of straight run products.

UNIT III **9**
Vacuum distillation Column internals and operational aspects for lubes and asphalt's Cracking feed stocks.

UNIT IV **9**
Pressure distillation and gas fractionating units. Difference between various types of distillation Regaining of products of pressure distillations.

UNIT V **9**
Lubrication oils, Specifications, characteristics, Production lube specialties, additives, Refining of lubrication oil-solvent chemical and hydrogenation method dew axing, deasphalting etc. Asphalt and asphalt specialties. Air blowing and emulsification techniques.

TOTAL : 45 PERIODS

OUTCOME:

Upon completion of this course, the students will be able to understand the concepts of atmospheric distillation, vaccum distillation and various refinery engineering concepts.

TEXT BOOKS:

1. B.K.Bhaskar Rao., "Modern Petroleum Refining Processes", 2nd Ed., Oxford and IBH publishing Co. Pvt. Ltd., New Delhi 1990.
2. W.C. Edmister "Applied Hydrocarbon Thermodynamics", Gulf Publishing, Houstan, Texas 1961.

REFERENCES:

1. W.L. Nelson, "Petroleum Refinery Engineering", McGraw-Hill, 1964.
2. M.V. Winkle, "Distillation, Chemical Engineering series", McGraw-Hill, 1961.

PE6003 PETROLEUM TRANSPORTATION ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

To get familiar with modes of transportation for oil and gas. To understand various transportation techniques, problems and remedial measures.

UNIT I MODES OF CRUDE OIL, PRODUCT AND GAS TRANSPORTATION AND PIPELINE TRANSPORTATION 9

Tank-Trucks and Rail Transportation, Oceanic Tanker Transportation, Inland Water, Coastal and Oceanic, Tanker Size, Power, Cargo Space, Marine Storage Terminals, Shore Installation. Line Specifications, Plastic Pipes.

UNIT II LIQUID TRANSPORT & GAS TRANSPORTATION 9

Crude Oil and Product Flow Characteristics, Transportation of Cryogenic Liquids, Heat Flux Estimation, Temp Gradient in Flowing fluid in Exposed and Buried Pipeline, Insulation Types and thickness, Rheology and Non-Newtonian Behaviour, Stress and Pressure Drop Calculations. Flow Equation, Pressure Drop Calculations. Wey Mouth and Panhandle Equation, Design Factors. Pressure Drop in Non-Horizontal Pipeline. Stress Conditions in Pipeline and Analysis.

UNIT III BRANCHING AND LOOPING IN PIPELINES AND MULTIPHASE FLOW 9

Equivalent Diameter and Length Combined Capacity. Steady State Flow in Pipes, Flow Networks.

Flow pattern in Gas- Liquid Flow, Pressure Drop Estimation, Design Consideration. Pipe Sizing, Storage Capacity, Station Spacing. Transportation Problems and Remedial Measures, Pressure Surges, Scaling, Wax deposition, Gas Hydrate Formation.

UNIT IV PIPELINE PRACTICE AND EQUIPMENT AND SURFACE PROTECTION 9

Route Survey, Transportation, Trenching, Stringing, Bending, Cleaning and Coating, Lowering and Back Filling, Inspection, Testing, Internal Cleaning, Road, Bridge and River Crossing. Welding: Techniques and Equipment

Internal and External Corrosion & Protection, Cathode Protection System.

UNIT V AUXILIARY EQUIPMENT/ FACILITIES AND PUMPS & COMPRESSOR STATION 9

Valves, Regulators, Types and Operating Features. Metering & Storage: Flow Meter Types, Calibration, Proving, Heating Value. Storage of Crude, Product, Natural Gas and LNG.
Layout, Equipment, Instrumentation, Prime Movers: Two stroke vs Four Stroke. Naturally Design Aspirated vs Super Charged Engines, Gas Turbines, Single vs Multi Shaft Turbines, Emission Control.

TOTAL : 45 PERIODS

OUTCOME:
Students will have understanding on transportation techniques and the auxiliary equipments involved in the transportation process.

TEXT BOOKS:
1. The Petroleum Shipping Industry: Operations and Practices, Penwell Books, 1996.
2. Introduction to the Oil Pipeline Industry (Oil Pipeline Transportation Practices), he University of Texas at Austin - Petroleum Extension Service; 3rd edition 1984.

PE6004 MAJOR HAZARDS MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:
To understand the basic concepts of geology and its perspectives. To create the awareness of various natural environmental hazards and management.

UNIT I 9
Geology and its perspectives. Formation of core, mantle, crust, hydrosphere, atmosphere and biosphere - Elementary ideas of continental drift and plate tectonics - Evolution of ocean and continental basins.

UNIT II 9
Ecology, ecosystem and biotic communities, human impact on air, land, soil, water, climate and forest resources - conservation of resources, coping with natural hazards.

UNIT III 9
Natural Environmental Hazards: Various domains and classes of natural hazards- tropical cyclones, floods, landslides and earthquakes - Prediction control and awareness of earthquakes- volcanic types, distribution and causes - coastal erosion.

UNIT IV 9
Introduction to Environmental Hazards Management - Global Climate Change: Causes, trends, consequences, and management challenges- Mitigation measures of volcanoes, prevention and controls of landslides.

UNIT V 9
Environmental degradation and pollution - Air pollution - Water pollution and Soil pollution. Cyclones- types and effects - Droughts- types and factors contribution for drought - Floods- causes and forecast.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the students would have

- Learnt the basic concepts relating to major hazards, risk, and ethics
- Gained the knowledge of environmental hazard management

TEXT BOOKS:

1. Smith, K. Environmental Hazards: Assessing Risk and Reducing Disaster. Third Edition. 2001. Routledge Press.
2. Burton, I, R.W. Kates, and G.F. White, The Environment as Hazard, Second Edition. Guilford Press. 1993.

REFERENCE:

1. Godschalk, et. al., Natural Hazard Mitigation: Recasting Disaster Policy and Planning. Island Press. 1999.

PE6005 PETROLEUM CORROSION TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

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

UNIT I **9**

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

UNIT II **9**

Forms of corrosion-uniform-pitting-Galvanic erosion-Intergranualar and weld corrosion, selective Leaching, stress corrosion. Hydrogen embitterment-Fatigue. Role of oxygen in oil filed corrosion-downhole and surface equipment-water flood Removal of oxygen, analysis and criteria for control.

UNIT III **9**

Role of carbon dioxide (CO_2) in corrosion-Effect of temperature and pressure Corrosion of well tubing and other equipments. Role of hydrogen sulphide (H_2S)-Corrosion in downhole, surface, storage and pipelines.

UNIT IV **9**

Corrosion prevention-Cathodic protection. Principles of operation-applications Galvanic systems, corrosion prevention-coatings-corrosion prevention inhibitors-types of corrosion inhibitors-choice and selection.

UNIT V **9**

Oil treatment corrosion-crude oil properties-desalting-distillation and other processing case histories, sweetening processes-subsea systems corrosion. Inspection and corrosion monitoring case history-oil storage tank corrosion-Oilfield and oil treating facilities-offshore platforms-down hole equipments.

TOTAL: 45 PERIODS

OUTCOME:
Students will identify and define the various types of petroleum corrosion and prevention technologies.

TEXT BOOKS:
1. "Corrosion control in Petroleum production"-TPC 5-2-nd edition H.G.Byars Houston, texas, 1995.
2. Chemical engineering series, coulson and Richardson, Mc Graw Hill Publications.

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

PE6006 ADVANCED TOPICS IN GEOPHYSICS L T P C
3 0 0 3

OBJECTIVE:
To understand the physics and geology that form the basis for geophysical observation and measurement; to understand earth structure and evolution. To identify the physical processes governing the behavior of common geophysical systems.

UNIT I **9**
Physical Basis of Geophysical exploration – Various surface and sub surface methods and their classifications – Physical Properties of rocks and minerals exploited in exploration and factors that control them Geophysical anomalies

UNIT II **9**
Gravity Prospecting – Principles – Earth Gravitational Field Units – Variations in the Gravitational field – Newton's Law – Geoid , Spheroid and normal gravity field – Absolute and relative measurement of Gravity – Gravimeters and their field operation – Field procedure – Interpretation of Gravity data and Applications of Gravity methods.

UNIT III **9**
Radiometric Prospecting: Fundamentals of radioactivity – Rate of radioactivity decay – Successive disintegration and radioactive equilibrium – Natural radioactive elements – Radio active Series – Nature of radioactive emission – Artificial radioactivity – Radioactivity of rocks. Radiation measuring devices – Processing and Interpretation data – applications of radiometric methods.

UNIT IV **9**
Seismic methods, fundamentals of elasticity – bulk modulus – Poisson's ratio – Elastic Seismic wave theory – Body and surface waves – Primary and Secondary waves – Seismic Instruments - Seismic channels – Applications of Seismic data – Interpretation of field data

UNIT V **9**
Introduction to Well logging techniques – Well conditions – SP and Resistibility logging – Qualitative interpretation of SP and resistibility logs – applications.

TOTAL : 45 PERIODS

OUTCOMES:
Students would be able to recognize the geophysical exploration. They will also be able to understand about the radiometric prospecting systems and various seismic methods.

TEXT BOOKS:
1. Introduction to Geophysics by Dobrin.
2. Principles of Geophysics by Ramachandran.
3. Quantitative Geophysics and Geology by Louis Lliboutry.

REFERENCE:
1. Principles of applied Geophysics by D.S. Paranis

PE6007 STORAGE AND TRANSPORTATION OF CRUDE OIL AND NATURAL GAS **L T P C**
3 0 0 3

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

UNIT I INTRODUCTION **9**
Crude oil Trade, Selection of Port Location, Ship Building/Shipyards.

UNIT II NATURAL GAS REGASIFICATION TECHNOLOGY **9**
Commercial Sourcing of Natural Gas, Different Kinds of Regasification Techniques, Regasification Process & Cold Utilization, Synchronization of Degasified gas and Pipelines, Current Status in India

UNIT III CRUDE OIL TRANSPORTATION **9**
Transportation techniques of crude oil, Pipeline specification, Corrosion Prevention techniques, Pressure drop, Pumps and Booster station, Wax deposition and prevention, Chemical treatment

UNIT IV DESIGN **9**
Basic Engineering Aspects of Terminal Design, Design of Liquefaction Train, Ship Building/Shipyards, Storage Facilities

UNIT V CHARTERTICS OF STORAGE **9**
Supply & Demand, Variation Gas Field & Aquifers, Technical Qualities and Storage, Properties of Storage Reservoir, Rocks & Fluids.
Flow through Storage Reservoir; Inventory Concept, Pressure- Content Hysteresis, Inventory Verification, Gas Flow Performance, Gas Deliverability.
Design & Development of Underground Storage Fields: Operation of Storage Fields. Threshold Pressure. Water Influx/Efflux Quantities. Aquifer Equilibrium Pressure. Error and Uncertainty.
Gas Storage in Salt Cavity & Caverns: Thermodynamics, Temperature and Pressure Effect. Recent Developments
Advanced Storage Techniques, Case Histories.

TOTAL : 45 PERIODS

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

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

PE6008 COMPUTER AIDED PROCESS PLANT DESIGN L T P C
3 0 0 3

OBJECTIVE:
To understand the use of computer aided tools for process plant design.

UNIT I **9**
Introduction to process plant design - Properties Evaluation: Spread sheeting, Hierarchy of Process Design and the Onion model - Flow sheeting - Typical units of CAD system - Process synthesis - Physical properties evaluation –Transport properties & thermodynamic properties of gases and binary mixtures.

UNIT II **9**
Basic Model Development For Preliminary Systems: Methods of calculating vapor liquid equilibrium data for ideal and non-ideal mixtures - Bubble point and Dew point - Flash and distillation calculations - Equipment design - Development of software programmes for the following systems - Piping system, single phase & two phase.

UNIT III **9**
Cad Model For Fluid Moving Machinery & Storage Design: Separator system - Two phase and three phase - Storage system - Atmospheric, pressurized & cryogenic.

UNIT IV **9**
Cad Model For Heat Transfer Equipment Design: Double pipe - Shell and tube heat exchanger - PHE - Air cooler - Heat integration of evaporators.

UNIT V **9**
Cad Model For Mass Transfer Equipment And Safety Devices Design: Binary mixtures - Pseudo binary - Multistage distillation system - Heat integration of distillation columns - Absorber and strippers - Liquid-liquid extractors - Safety devices-pressure safety valve & flare system

TOTAL : 45 PERIODS

OUTCOME:
Students would be able to use computer-aided conceptual design tools for the design and simulation of chemical process flow sheets at each level of process development.

TEXT BOOKS:
1. B.C. Bhattacharyya and C.M. Narayanan, “Computer Aided Design of Chemical Process Equipment", Ist Edn., New Central Book Agency (P) Ltd., New Delhi, 1992.
2. James M. Douglas “Conceptual Design of Chemical Processes”, McGraw Hill, New York, 1981.

REFERENCES:

1. Hussein, "Chemical Process Simulation", Wiley Eastern, 1986.
2. A.K. Coker, “FORTRAN Programme for Chemical Process Design, Analysis and Simulation”, Gulf Publishing Co., 1995.

PE6009 ADVANCED DRILLING ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

To enable the students to understand the advanced concepts and techniques used in drilling engineering

UNIT I **9**

Drilling and Well Servicing structures – Definitions – Design specifications – Maintenance and use of Drilling and wall servicing structures.

UNIT II **9**

Hoisting Systems - -Design – Rating and Testing – Inspections – Supplementary and Requirements – Manufacture and Tolerances

UNIT III **9**

Rotary Equipments - Swivel and Rotary Hose – Rotary Table and Bushing - Bits and Down hole tools.

UNIT IV **9**

Mud Pumps – Pump installations – Pump operations – Drilling Muds and Completion fluids – Suspended solids and Transport Cuttings – Nonaqueous fluids – Oil base and synthetic – Base muds – Drilling fluids activities – Clay chemistry

UNIT V **9**

Drill strings – compositions and design – Drill Collar – Drill Pipe – Tools Joints –Drill String Design.

TOTAL : 45 PERIODS

OUTCOME:

Students will be able to understand the concepts of various equipment’s and techniques involved in the drilling operations.

TEXT BOOKS:

1. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing.
2. 1.Rabia.H. ‘Oil Well Drilling Engineering, Principles And Practices’ Graham And Trotman Ltd. 1985.

REFERENCE:

1. Mc.Cray. A.W and Cole.F.W. ‘Oil Well Drilling Technology’ University of Oklahoma Press, Norman 1959.

PE6010 WELL COMPLETION AND SIMULATION L T P C
3 0 0 3

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

UNIT I **9**
Well Design: Prediction of formation pore pressure and stress gradients. Determination of safety mud weight bounds for different in-situ stress conditions. Design and planning well trajectory. Surveying tools and methods.

UNIT II **9**
Design of drill string including bottom hole (BHA) assembly. Drilling methods and equipment for directional, horizonatal and multilateral wells. Selection of casing shoes, material properties and design of casing program.

UNIT III **9**
Well Completion and Stimulation: Well completion design, types of completion, completion selection and design criteria. Interval selection and productivity Considerations: effects of producing mechanisms. Inflows performance and multiple tubing performance analyses using commercial software.

UNIT IV **9**
Well stimulation and work over planning. Tubing-packer m0ovement and forces. Tubing design: graphical tubing design and simplified tensional strength design. Selection of down hole equipment, tubing accessories and wellhead equipment.

UNIT V **9**
Basic of perforation, selection of equipment and procedure for perforation oil and gas wells. Technology of sand control: gravel packing. Fundamentals of well stimulation technologies: acidisation and hydraulic fracturing.

TOTAL : 45 PERIODS

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

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

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

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

PE6011 **PETROLEUM ECONOMICS** **L T P C**
3 0 0 3

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

UNIT I **9**
Supply and demand curves, the elasticity of supply and demand, public finance concepts such as consumer surplus, excise and export taxes. Forecasting techniques for the energy industry, including energy prices. Demand and supply for natural gas, cured oil and pipeline transportation, determinants of energy demand, energy markets, energy pricing, stability and performance of energy markets.

UNIT II **9**
The economics of investment, Discounted cash flow analysis, Cost Benefit Analyses, Internal Rate of Return, NPV, Profitability Index, Natural Monopoly theory, National competition Policy, Gas Market Regulation, taxation of the oil and gas industry, government policy and trade permits, Monte Carlo analysis, Net Back Pricing, Transfer Pricing and regulatory aspects.

UNIT III **9**
Application of petroleum engineering principles and economics to the evaluation of oil and gas projects, evaluation principles, time value of money concepts, investment measures, cost estimation, price and production forecasting, risk and uncertainty, project selection and capital budgeting inflation, escalation, operating costs, depreciation, cost recovery**.**

UNIT IV **9**
Petroleum exploration and production contracts. Sharing of the economic rent, portfolio management. Value creation, Corporate finance & return on capital, economic appraisal methods for oil filed development, reservoir model costs and calculations.

UNIT V **9**
Case studies: Economic study of an oil filed development project, petrochemical plant project, natural gas break even price, natural gas liquefaction cost, LGN transport cost, investment profitability study for a gas pipeline.

TOTAL : 45 PERIODS

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

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

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

PE6012 BIOCHEMICAL ENGINEERING L T P C
3 0 0 3

OBJECTIVE:
This course mainly to discuss the role of enzymes and microbes in biotechnology sectors.

UNIT I **9**
Introduction to biochemical process industries. Industrial alcohols, antibiotics, acids, alcoholic beverages, enzymes, vitamins, single cell protein. Food processing and biological waste treatment. Interaction of chemical engineering principles with biological sciences.

UNIT II **9**
Life processes, unit of living system, microbiology, reaction in living systems, biocatalysts, model reactions. Fermentation mechanisms and kinetics: Kinetic models of microbial growth and product formation Fermenter types.

UNIT III **9**
Modeling of batch and continuous fermentor. Bioreactor design, mixing phenomena in bioreactors. Sterilization of media and air, sterilization equipment, batch and continuous sterilize design.

UNIT IV **9**
Biochemical product recovery and separation. Membrane separation process: reserve osmosis, dialysis, ultra filtration; Chromatographic methods: adsorption chromatography, gel filtration affinity chromatography etc.

UNIT V **9**
Electro-kinetic separation: electro-dialysis, electrophoresis. Waste water treatment: activated sludge process, anaerobic digestion, and trickling filter.

TOTAL : 45 PERIODS

OUTCOME:
Students will develop the ability to design novel bioprocesses for their research in various areas. They attain the ability to find solutions to the problems which occur when materials and processes interact with the environment.

TEXT BOOK:
1. Biochemical engineering, Bailey, Tata Mc Graw hill publications.Chemical engineering series, coulson and Richardson, Mc Graw Hill Publications.

PE6013 CHEMICAL KINETICS AND REACTOR DESIGN L T P C
3 0 0 3

OBJECTIVES:
To teach the students to
- Perform material balances to derive general reactor design equations
- Use the appropriate reaction kinetics in the reactor design equations
- Know the modelling of chemical reactors.

UNIT I **9**
Analysis of Noncatalytic fluid solid reaction: Kinetics of non-catalytic fluid-particle reactions, various models, application to design.

UNIT II **9**

Catalyst preparation and characterization: Catalysis - Nature of catalyses, methods of evaluation of catalysis, factors affecting the choice of catalysts, promoters, inhibitors, and supports, catalyst specifications, preparation and characterization of catalysts, surface area measurement by BET method, pore size distribution, catalyst, poison, mechanism and kinetics of catalyst, deactivation.

UNIT III **9**

Physical adsorption and chemical adsorption: Fluid-fluid reactions different regimes, identification reaction regime, application to design. Physical absorption with chemical reaction, simultaneous absorption of two reacting cases consecutive reversible reactions between gas and liquid, irreversible reactions, estimation of effective interfacial area in absorption equipment.

UNIT IV **9**

Reaction kinetics, accounting porous nature of catalyst: Heterogeneous catalytic reactions - effectiveness factor, internal and external transport processes, non-isothermal reacting systems, uniqueness and multiplicity of steady states, stability analysis.

UNIT V **9**

Modeling of chemical reactors: Modeling of multiphase reactors - Fixed, fluidized, trickle bed, and slurry reactors.

TOTAL : 45 PERIODS

OUTCOME:

Students would be able to discern reaction kinetics by analyzing data from a variety of reactor types.

TEXT BOOKS:

1. G.F. Froment, K.B. Bischoff, "Chemical Reactor Analysis and Design", 2nd ed., John Wiley, New York, 1990.
2. O. Levenspiel, "Chemical Reaction Engineering", 3rd edition, Wiley Singapore, 2000.

REFERENCES:

1. J.J. Carberry “Chemical and Catalytic Reaction Engineering", McGraw Hill, New York, 1976.
2. R. Aris, "Elementary Chemical Reactor Analysis", Prentice Hall, 1969.

PE6014 **PRINCIPLES OF GEOCHEMISTRY** **L T P C**
3 0 0 3

OBJECTIVES:

Student will learn about the concepts of

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

UNIT I **9**

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

UNIT II **9**

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

UNIT III **9**

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

UNIT IV **9**

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

UNIT V **9**

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

TOTAL : 45 PERIODS

OUTCOME:

Upon completion of this course, the students would

Gain knowledge on the principles and concepts of geochemistry

Select appropriate techniques to obtain information on the chemical composition of sedimentary rocks and fluids such as oils and gases

TEXT BOOKS:

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

REFERENCES:

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

GE6075 PROFESSIONAL ETHICS IN ENGINEERING **LT P C**
3 0 0 3

OBJECTIVES:

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

UNIT I HUMAN VALUES **10**

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

UNIT II ENGINEERING ETHICS **9**

Senses of ‘Engineering Ethics’ – Variety of moral issues – Types of inquiry – Moral dilemmas –

Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

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

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

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

UNIT V GLOBAL ISSUES 8

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

TOTAL: 45 PERIODS

OUTCOME :

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

TEXTBOOKS:

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

REFERENCES:

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

Web sources:

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

GE6757 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVE :
To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION 9
Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES 9
Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9
Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY SYSTEMS 9
Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

TOTAL: 45 PERIODS

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

TEXTBOOK:
1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

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