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.
## ANNA UNIVERSITY, CHENNAI
### AFFILIATED INSTITUTIONS
#### R - 2013
#### B. TECH. PETROLEUM ENGINEERING
#### I – VIII SEMESTERS CURRICULUM AND SYLLABUS

### SEMESTER - I

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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:

REFERENCES:

EXTENSIVE Reading (Not for Examination)

WEBSITES:

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

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

UNIT II          SEQUENCES AND SERIES

UNIT III          APPLICATIONS OF DIFFERENTIAL CALCULUS
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes - Evolute as envelope of normals.

UNIT IV          DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES

UNIT V          MULTIPLE INTEGRALS

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:

REFERENCES:
OBJECTIVES:

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

UNIT I CRYSTAL PHYSICS (9 periods)

- 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 periods)

- 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

UNIT III QUANTUM PHYSICS (9 periods)


UNIT IV ACOUSTICS AND ULTRASONICS (9 periods)

- 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 periods)

- 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.

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.

TOTAL: 45 PERIODS
TEXT BOOKS:
1. Arumugam M. Engineering Physics. Anuradha publishers, 2010

REFERENCES:
1. Searls and Zemansky. University Physics, 2009
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 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

UNIT IV PHASE RULE AND ALLOYS 9
Phase rule: Introduction, definition of terms with examples, One Component System - water

UNIT V NANOCHEMISTRY
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

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:

REFERENCES:

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
UNIT II  
C PROGRAMMING BASICS

UNIT III  
ARRAYS AND STRINGS

UNIT IV  
FUNCTIONS AND POINTERS

UNIT V  
STRUCTURES AND UNIONS
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.

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:

REFERENCES:
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 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:
REFERENCES:

Publication of Bureau of Indian Standards:

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

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
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

IV ELECTRONICS ENGINEERING PRACTICE
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.
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:
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.
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.
5. Study purpose items: Telephone, FM radio, low-voltage power supply
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
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)
Determination of DO content of water sample by Winkler’s method.
Determination of chloride content of water sample by argentometric method.
Determination of strength of given hydrochloric acid using pH meter.
Determination of strength of acids in a mixture using conductivity meter.
Estimation of iron content of the water sample using spectrophotometer.
(1,10-phenanthroline / thiocyanate method).
Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
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:

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
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
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
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
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
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:**

**REFERENCES:**

**EXTENSIVE Reading (Not for Examination)**

**Websites**
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

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
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:

REFERENCES:

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

UNIT II  SEMICONDUCTING MATERIALS  9

UNIT III  MAGNETIC AND SUPERCONDUCTING MATERIALS  9
Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity (Qualitative) – High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV  DIELECTRIC MATERIALS  9

UNIT V  ADVANCED ENGINEERING MATERIALS  9

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:

REFERENCES:

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

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 H₂ -O₂ 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

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 ,
REFERENCES:

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 & MEASUREMENTS 12
Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS 12

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12

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
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:

REFERENCES:

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

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

UNIT IV DYNAMICS OF PARTICLES 12

UNIT V FRICITION AND ELEMENTS OF RIGID BODY DYNAMICS

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.

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:

REFERENCES:

GE6261 COMPUTER AIDED DRAFTING AND MODELING LABORATORY

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,
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:

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

GE6262 PHYSICS AND CHEMISTRY 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 BaCl₂ and Na₂SO₄  

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:  
• 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, porcelain tile, dropper (30 Nos each)
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
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

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

UNIT V  Z-TRANSFORMS AND DIFFERENCE EQUATIONS  9 + 3

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:

REFERENCES:

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

UNIT II

UNIT III
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

UNIT V
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:

REFERENCES:

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, paleomagnetism, geothermal and electrical properties.

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
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

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

UNIT II
- 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
- 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

UNIT V

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:

REFERENCES:

CH6361 HEAT TRANSFER

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
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
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
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

UNIT V
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:

REFERENCES:

PE6304 ENGINEERING THERMODYNAMICS

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

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

UNIT III POWER CYCLES, THERMODYNAMIC POTENTIALS, EQUILIBRIA AND STABILITY

UNIT IV PROPERTIES OF PURE COMPONENTS AND MIXTURES

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

TOTAL : 45 PERIODS

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:

REFERENCES:

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

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

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

UNIT I RANDOM VARIABLES
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:

REFERENCES:

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  
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  

UNIT III  
LIQUID-LIQUID EXTRACTION  
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  
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  
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.

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:

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

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

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:
2. Djebar Tiab : “Theory and pratice of measuring Reservoir rock and fluid Transport properties

REFERENCE:
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

UNIT II

UNIT III

UNIT IV

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

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:

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

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
Reservoir evolution – Reservoir management. Process model. Effect of rock and fluid properties. Flow surveillance and porosity 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:
RESERVOIR ENGINEERING I

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

UNIT II

UNIT III

UNIT IV

UNIT V
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:
REFERENCES:
1. Dake, L.P. Practice of Reservoir Engineering Elsevier 2001

PE6411 PETROLEUM TESTING LABORATORY

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. Corrosion testing of petroleum oils and copper
7. Freezing point of Aqueous Engine coolant solution
8. Automatic Vacuum EDistillation
9. Characteristics of Hydrocarbon types in Petroleum products
10. Coking tendency of oil
11. Saybolt color 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

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

UNIT II
UNIT III

UNIT IV

UNIT V
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:
2. D.P Helander ‘Fundamentals Of Formation Evaluation’

REFERENCE:

PE6502 WELL LOGGING

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

UNIT I
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
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
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

UNIT V
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:
2. D.P Helander ‘Fundamentals Of Formation Evaluation’

REFERENCE:

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
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

UNIT III  9
Types of equipment and methods used in cementing operations. Drilling fluid and cement slurry hydraulics.

UNIT IV  9

UNIT V  9

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:

REFERENCES:

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

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

UNIT V
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

PE6505 RESERVOIR ENGINEERING - II

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

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

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

UNIT III
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

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

TEXT BOOKS:

REFERENCE:

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

UNIT V  HUMAN POPULATION AND THE ENVIRONMENT  6

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:**

**REFERENCES:**

**GE6674 COMMUNICATION AND SOFT SKILLS- LABORATORY BASED**

**OBJECTIVES:**
To enable learners to,

- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

**UNIT I LISTENING AND SPEAKING SKILLS**
Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.

**UNIT II READING AND WRITING SKILLS**
Reading different genres of tests ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

**UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS**
International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service(Language related)- Verbal Ability.
UNIT IV INTERVIEW SKILLS

Different types of Interview format- answering questions- offering information- mock interviews- body language (paralinguistic features)- articulation of sounds- intonation.

UNIT V SOFT SKILLS

Motivation- emotional intelligence-Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership straits-team work- career planning - intercultural communication- creative and critical thinking

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:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description of Equipment (minimum configuration)</th>
<th>Qty Required</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Server</td>
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<tr>
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<td>• PIV System</td>
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<td>• PIII or above</td>
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<td>• 256 or 512 MB RAM / 40 GB HDD</td>
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<td>Audio Mixer</td>
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<td>8</td>
<td>DVD recorder/player</td>
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<tr>
<td>9</td>
<td>LCD Projector with MP3/CD/DVD provision for Audio/video facility</td>
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</table>

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, and case studies.

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:
2. Graded Examinations in Spoken English and Spoken English for Work downloadable materials from Trinity College, London.
4. Interactive Multimedia Programs on Managing Time and Stress.

Web Sources:
http://www.slideshare.net/rohitjsh/presentation-on-group-discussion
http://www.washington.edu/doit/TeamN/present_tips.html
http://www.oxforddictionaries.com/words/writing-job-applications
http://www.kent.ac.uk/careers/cv/coveringletters.htm
http://www.mindtools.com/pages/article/newCDV_34.htm

GEOLOGY LABORATORY

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 Megascopics 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

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**PE6512 DRILLING FLUIDS AND CEMENTING TECHNIQUES LABORATORY**

**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 slurries 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 consistometer.
- 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 °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).

**TOTAL : 45 PERIODS**

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

**LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS**
- 1) Mud balance
- 2) Picnometer and F.G.T meter
3) 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

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<th>Course Code</th>
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<td>PE6601</td>
<td>RESERVOIR CHARACTERIZATION AND MODELING</td>
<td>3</td>
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**OBJECTIVE:**
To enable the students to follow and utilize different concepts of reservoir modeling and characteristics and their usage.

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

**UNIT II**

**UNIT III**

**UNIT IV**
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**

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

UNIT I

UNIT II

UNIT III
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

UNIT V
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:

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

UNIT I

UNIT II
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
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
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

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:
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:

REFERENCES:
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

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

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

UNIT V
POLYMERISATION Models and Techniques, 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:

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

UNIT I

UNIT II
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

UNIT IV

UNIT V

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:

REFERENCE:
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

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

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:

REFERENCES:
PE6612 PROCESSES CONTROL AND INSTRUMENTATION LABORATORY

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 offered.

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

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

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

UNIT IV

UNIT V
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:

REFERENCE:
1. Petroleum Exploration Hand Book by Moody, G.B.
OBJECTIVE:
To impart knowledge on different oil/gas field evaluations in order to maximize the production and improvement of facilities.

UNIT I

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

UNIT V

TOTAL : 45 PERIODS

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

TEXT BOOKS:
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
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
Design of Surface Facilities -Design of production and processing equipment, including departure problems, treating, and transmission systems.

UNIT III
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

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

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

UNIT II

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

UNIT IV
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

TOTAL : 45 PERIODS

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

TEXTBOOK:

REFERENCE:
1. Petroleum Exploration Hand Book by Moody, G.B.
OBJECTIVE:
To enable the students to understand the basics of oil recovery methods in oil & gas Industry.

UNIT I

UNIT II
Chemical oil recovery methods – Polymer, surfactant/polymer and alkaline flooding – Carbon dioxide (CO₂) flooding.

UNIT III

UNIT IV

UNIT V
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:

REFERENCE:
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 software for Drafting and Modeling – 30 Licenses.
3. Laser Printer or Plotter to print / Plot drawings – 2 Nos.

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. Vacuum 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.

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**PE6801 RISK ASSESSMENT AND SAFETY ENGINEERING**

**OBJECTIVES:**
To enable the students to
- Become a skilled person in hazard 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.

**UNIT II**
9

**UNIT III**
9

**UNIT IV**
9
Safety measures in handling and storage of chemicals – Fire chemistry and its control – Personnel protection – Safety color codes of chemicals.

**UNIT V**
9

**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:**

**REFERENCES:**

**PE6001 MARKETING FUNDAMENTALS**

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

**UNIT III PRODUCT PRICING AND MARKETING RESEARCH**
Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

**UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION**
Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

**UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION**
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:**

**REFERENCES:**

**PE6002 REFINERY ENGINEERING**

**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**
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**

**UNIT III**
Vacuum distillation Column internals and operational aspects for lubes and asphalt’s Cracking feed stocks.
UNIT IV
Pressure distillation and gas fractionating units. Difference between various types of distillation
Regaining of products of pressure distillations.

UNIT V
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, vacuum distillation and various refinery engineering concepts.

TEXT BOOKS:
   1961.

REFERENCES:

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

UNIT IV   PIPELINE PRACTICE AND EQUIPMENT AND SURFACE PROTECTION     9

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

TOTAL : 45 PERIODS

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

TEXT BOOKS:
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

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

UNIT I
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
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
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
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
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:

REFERENCE:

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

UNIT II
Forms of corrosion-uniform-pitting-Galvanic erosion-Interstitial 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
Role of carbon dioxide (CO₂) in corrosion-Effect of temperature and pressure Corrosion of well tubing and other equipments. Role of hydrogen sulphide (H₂S)-Corrosion in downhole, surface, storage and pipelines.
UNIT IV

UNIT V
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:

REFERENCE:

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
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

UNIT III
UNIT IV
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
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.

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

PE6007 STORAGE AND TRANSPORTATION OF CRUDE OIL AND NATURAL GAS

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

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

UNIT II NATURAL GAS REGASIFICATION TECHNOLOGY
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
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
Basic Engineering Aspects of Terminal Design, Design of Liquefaction Train, Ship Building/Shipyards, Storage Facilities

UNIT V CHARTERTICS OF STORAGE
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.
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:

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

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

UNIT IV

UNIT V

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:

REFERENCES:

PE6009 ADVANCED DRILLING ENGINEERING

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

UNIT I

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

UNIT III
Rotary Equipments - Swivel and Rotary Hose – Rotary Table and Bushing - Bits and Downhole tools.

UNIT IV
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

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:

REFERENCE:

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

UNIT II
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
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
Well stimulation and work over planning. Tubing-packer movement and forces. Tubing design: graphical tubing design and simplified tensitional strength design. Selection of down hole equipment, tubing accessories and wellhead equipment.

UNIT V

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:

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

PE6011 PETROLEUM ECONOMICS

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

UNIT I
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
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
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
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
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:

REFERENCES:

GE6083 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in
Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to

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

TEXTBOOKS:

REFERENCES
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

PE6012 BIOCHEMICAL ENGINEERING

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

UNIT I

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

UNIT V  

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:  
UNIT V
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:

REFERENCES:

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:

REFERENCES:

GE6075 PROFESSIONAL ETHICS IN ENGINEERING

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

UNIT II ENGINEERING ETHICS

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS

UNIT V GLOBAL ISSUES
Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and
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:

REFERENCES:

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

GE6757 TOTAL QUALITY MANAGEMENT

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

UNIT I INTRODUCTION 

UNIT II TQM PRINCIPLES
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
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

UNIT V QUALITY SYSTEMS

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

TEXTBOOK:

REFERENCES:

GE6084 HUMAN RIGHTS L T P C
3 0 0 3

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

UNIT I

UNIT II

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

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.
UNIT V

TOTAL : 45 PERIODS

OUTCOME :
• Engineering students will acquire the basic knowledge of human rights.

REFERENCES