PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. To inculcate in students, a professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to solve problems encountered in petrochemical sector
II. To make the students conversant with oils and their properties, principles of chemical analysis and preparation of chemicals
III. To acquaint the students with the standards for the analysis of petroleum products
IV. To give them an opportunity to gain knowledge on various reaction mechanisms
V. To help the students understand the theory, instrumentation and applications of analytical equipments used in industries for testing the quality of petroleum, intermediates and products
VI. To make them learn basic rock and fluid properties relevant to petroleum reservoirs
VII. To teach the students to solve chemical engineering problems using C and MATLAB and other computational tools
VIII. To given an introduction to the students on control systems along with instrumentation

PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

I. Graduates will be able to demonstrate their knowledge professionally and shoulder ethical responsibilities
II. Graduates will be capable to design experiments, analyze and interpret data
III. Graduates will be able to meet the world's ever-increasing demand for hydrocarbon fuel, thermal energy, and waste and pollution management
IV. Graduates will gain a knowledge of the basic principles involved in different chemical synthesis and will be able to apply them in chemical industries
V. Graduates will have the capacity to choose a proper measuring instrument for a parameter to be measured
VI. Graduates will have a knowledge of different analytical techniques and shall apply them to analyze chemical and petrochemical products
VII. Graduates will understand the characteristics of source and reservoir rocks
VIII. Graduates will become familiar with environmentally sound exploration, evaluation and recovery of oil, gas and other fluids in the earth
IX. Graduates will have the ability to solve chemical engineering problems.
X. Understand the pre requisites of control strategies and the mechanism of advance control systems
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# ANNA UNIVERSITY :: CHENNAI 600 025
UNIVERSITY DEPARTMENTS
B. TECH. PETROLEUM ENGINEERING AND TECHNOLOGY
R – 2015
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI I - VIII SEMESTERS

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### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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### SUMMARY

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Non-Credit/ Mandatory
COURSE DESCRIPTION:
This course aims at developing the language skills necessary for the first year students of Engineering and Technology.

OBJECTIVES:
• To develop the four language skills – Listening, Speaking, Reading and Writing.
• To improve the students’ communicative competence in English.
• To teach students the various aspects of English language usage.

CONTENTS
UNIT I  GREETING AND INTRODUCING ONESELF  12
Listening - Types of listening – Listening to short talks, conversations; Speaking – Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family/ friend; Reading – Skimming a passage– Scanning for specific information; Writing – Guided writing - Free writing on any given topic ( My favourite place/ Hobbies/ School life, writing about one’s leisure time activities, hometown, etc.); Grammar – Tenses (present and present continuous) -Question types - Regular and irregular verbs; Vocabulary – Synonyms and Antonyms.

UNIT II  GIVING INSTRUCTIONS AND DIRECTIONS  12
Listening – Listening and responding to instructions; Speaking – Telephone etiquette - Giving oral instructions/ Describing a process – Asking and answering questions; Reading – Reading and finding key information in a given text - Critical reading - Writing – Process description( non-technical); Grammar – Tense (simple past& past continuous) - Use of imperatives – Subject – verb agreement – Active and passive voice; - Vocabulary – Compound words – Word formation – Word expansion ( root words).

UNIT III  READING AND UNDERSTANDING VISUAL MATERIAL  12
Listening- Listening to lectures/ talks and completing a task; Speaking – Role play/ Simulation – Group interaction; Reading – Reading and interpreting visual material; Writing – Jumbled sentences – Discourse markers and Cohesive devices – Essay writing (cause & effect/ narrative); Grammar – Tenses (perfect), Conditional clauses –Modal verbs; Vocabulary – Cause and effect words; Phrasal verbs in context.

UNIT IV  CRITICAL READING AND WRITING  12
Listening- Watching videos/ documentaries and responding to questions based on them; Speaking– Informal and formal conversation; Reading – Critical reading (prediction & inference); Writing – Essay writing ( compare & contrast/ analytical) – Interpretation of visual materials; Grammar – Tenses (future time reference); Vocabulary – One word substitutes (with meanings) – Use of abbreviations & acronyms – Idioms in sentences.

UNIT V  LETTER WRITING AND SENDING E-MAILS  12
Listening- Listening to programmes/broadcast/ telecast/ podcast; Speaking – Giving impromptu talks, Making presentations on given topics- Discussion on the presentation; Reading – Extensive reading; Writing– Poster making – Letter writing (Formal and E-mail) ; Grammar – Direct and Indirect speech – Combining sentences using connectives; Vocabulary – Collocation;

TEACHING METHODS:
Interactive sessions for the speaking module.
Use of audio – visual aids for the various listening activities.
Contextual Grammar Teaching.
EVALUATION PATTERN:
Internals – 50%
End Semester – 50%
TOTAL:60 PERIODS

LEARNING OUTCOMES:
- Students will improve their reading and writing skills
- Students will become fluent and proficient in communicative English
- Students will be able to improve their interpersonal communication

TEXTBOOK:

REFERENCES:
3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student’s Book & Workbook) Cambridge University Press, New Delhi: 2005

MA7151 MATHEMATICS – I  L  T  P  C
4 0 0 4
(Common to all branches of B.E. / B.Tech. Programmes in I Semester)

COURSE OBJECTIVES
- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I DIFFERENTIAL CALCULUS 12
Representation of functions - New functions from old functions - Limit of a function - Limits at infinity - Continuity - Derivatives - Differentiation rules - Polar coordinate system - Differentiation in polar coordinates - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12
multipliers.

UNIT III  INTEGRAL CALCULUS  12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV  MULTIPLE INTEGRALS  12

UNIT V  DIFFERENTIAL EQUATIONS  12
Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

TOTAL : 60 PERIODS

COURSE OUTCOMES
- Understanding of the ideas of limits and continuity and an ability to calculate with them and apply them.
- Improved facility in algebraic manipulation.
- Fluency in differentiation.
- Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
- Understanding the ideas of differential equations and facility in solving simple standard examples.

TEXT BOOKS

REFERENCE BOOKS
OBJECTIVE:
- To introduce the concept and different ways to determine moduli of elasticity and applications.
- To instill the concept of sound, reverberation, noise cancellation, and ultrasonic generation, detection and applications.
- To inculcate an idea of thermal properties of materials, heat flow through materials and quantum physics.
- To promote the basic understanding of interferometers, principles and applications of lasers, optical fibers and sensors.
- To establish a sound grasp of knowledge on the basics, significance and growth of single crystals.

UNIT I  PROPERTIES OF MATTER

UNIT II  ACOUSTICS AND ULTRASONICS

UNIT III  THERMAL AND MODERN PHYSICS

UNIT IV  APPLIED OPTICS

UNIT V  CRYSTAL PHYSICS
Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - Crystal
imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 PERIODS

OUTCOME:
- The students will understand different moduli of elasticity, their determination and applications.
- The students will gain knowledge on the properties of sound, noise cancellation, and production, detection and applications of ultrasonics.
- The students will acquire sound knowledge on thermal expansion and thermal conductivity of materials. Further they will gain an idea of quantum physics.
- The students will gain knowledge on interferometers, lasers and fiber optics.
- The students will secure knowledge on the basics of crystal structures and their significance. Further they gain basic ideas of growing single crystals.

TEXTBOOKS:

REFERENCES:

CY7151 ENGINEERING CHEMISTRY

3 0 0 3

COURSE OBJECTIVES
- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

UNIT I POLYMER CHEMISTRY
Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT II SURFACE CHEMISTRY AND CATALYSIS

15
UNIT III       PHOTOCHEMISTRY AND SPECTROSCOPY  9

UNIT IV       CHEMICAL THERMODYNAMICS  9
Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van’t Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.

UNIT V       NANOCHEMISTRY  9

TOTAL : 45 PERIODS

COURSE OUTCOMES
- Will be familiar with polymer chemistry, surface chemistry and catalysis.
- Will know the photochemistry, spectroscopy and chemical thermodynamics.
- Will know the fundamentals of nano chemistry.

TEXT BOOKS

REFERENCE BOOKS

GE7151         COMPUTING TECHNIQUES  L T P C
(Common to all branches of Engineering and Technology)  3 0 0 3

OBJECTIVES:
- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.
UNIT I  INTRODUCTION  9
Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II  C PROGRAMMING BASICS  9

UNIT III  ARRAYS AND STRINGS  9

UNIT IV  POINTERS  9
Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

UNIT V  FUNCTIONS AND USER DEFINED DATA TYPES  9

TOTAL : 45 PERIODS

OUTCOMES
At the end of the course, the student should be able to:
- Write C program for simple applications
- Formulate algorithm for simple problems
- Analyze different data types and arrays
- Perform simple search and sort.
- Use programming language to solve problems.

TEXTBOOKS:

REFERENCES:

BS7161  BASIC SCIENCES LABORATORY  L T P C
(Common to all branches of B.E. / B.Tech Programmes)  0 4 2

PHYSICS LABORATORY: (Any Seven Experiments)
OBJECTIVE:
- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
• To induce the students to familiarize with experimental determination of velocity of ultrasonic waves, band gap determination and viscosity of liquids.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young’s modulus
3. Uniform bending – Determination of young’s modulus
4. Lee’s disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box - Determination of Band gap of a semiconductor.
13. Viscosity of liquids - Determination of co-efficient of viscosity of a liquid by Poiseuille’s flow

TOTAL: 30 PERIODS

OUTCOME:
Upon completion of the course, the students will be able
• To determine various moduli of elasticity and also various thermal and optical properties of materials.
• To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

CHEMISTRY LABORATORY:
(Minimum of 8 experiments to be conducted)
1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline/thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 30 PERIODS

TEXT BOOKS
GE7161  COMPUTER PRACTICES LABORATORY  L  T  P  C
0  0  4  2

OBJECTIVES
- To understand the basic programming constructs and articulate how they are used to
develop a program with a desired runtime execution flow.
- To articulate where computer programs fit in the provision of computer-based solutions
to real world problems.
- To learn to use user defined data structures.

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
9. Program using Recursive Function
10. Program using structures and unions.

TOTAL: 60 PERIODS

OUTCOMES
At the end of the course, the student should be able to:
- Write and compile programs using C programs.
- Write program with the concept of Structured Programming
- Identify suitable data structure for solving a problem
- Demonstrate the use of conditional statement.

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS
30 Systems with C compiler

HS7251  TECHNICAL ENGLISH  L  T  P  C
4  0  0  4

OBJECTIVES
- To enable students acquire proficiency in technical communication.
- To enhance their reading and writing skills in a technical context.
- To teach various language learning strategies needed in a professional environment.

CONTENTS
UNIT I  ANALYTICAL READING 12
Listening- Listening to informal and formal conversations; Speaking – Conversation
Skills(opening, turn taking, closing )-explaining how something works-describing technical
functions and applications; Reading –Analytical reading, Deductive and inductive reasoning;
Writing- vision statement–structuring paragraphs.

UNIT II  SUMMARISING 12
Listening- Listening to lectures/ talks on Science & Technology; Speaking –Summarizing/ Oral
Reporting, Reading – Reading Scientific and Technical articles; Writing- Extended definition –
Lab Reports – Summary writing.
UNIT III  DESCRIBING VISUAL MATERIAL  12
Listening - Listening to a panel discussion;  Speaking – Speaking at formal situations;  Reading –Reading journal articles - Speed reading; Writing-data commentary-describing visual material-wrting problem-process- solution-the structure of problem-solution texts- writing critiques

UNIT IV  WRITING/ E-MAILING THE JOB APPLICATION  12
Listening- Listening to/ Viewing model interviews;  Speaking –Speaking at different types of interviews – Role play practice ( mock interview);  Reading – Reading job advertisements and profile of the company concerned;  Writing- job application – cover letter –Résumé preparation.

UNIT V  REPORT WRITING  12
Listening- Viewing a model group discussion;  Speaking –Participating in a discussion - Presentation;  Reading – Case study - analyse -evaluate – arrive at a solution;  Writing– Recommendations- Types of reports (feasibility report)- designing and reporting surveys- – Report format.- writing discursive essays.

TEACHING METHODS:
Practice writing
Conduct model and mock interview and group discussion.
Use of audio – visual aids to facilitate understanding of various forms of technical communication.
Interactive sessions.

EVALUATION PATTERN:
Internals – 50%
End Semester – 50%
TOTAL:60 PERIODS

LEARNING OUTCOMES
- Students will learn the structure and organization of various forms of technical communication.
- Students will be able to listen and respond to technical content.
- Students will be able to use different forms of communication in their respective fields.

TEXTBOOK:

REFERENCES:
COURSE OBJECTIVES

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- 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 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 MATRICES 12

UNIT II VECTOR CALCULUS 12
Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral – Area of a curved surface – Volume integral – Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTION 12
Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by functions \( w = z + c, \frac{az}{z}, \frac{1}{z} \) - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

UNIT V LAPLACE TRANSFORMS 12

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

- Evaluate real and complex integrals using the Cauchy integral formula and the residue theorem.
- Appreciate how complex methods can be used to prove some important theoretical results.
- Evaluate line, surface and volume integrals in simple coordinate systems.
• Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities
• Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.

TEXT BOOKS

REFERENCE BOOKS

PH7257 PHYSICS OF MATERIALS L T P C
(Common to Chemical, Ceramic, Food, Leather, Textile, Apparel, Industrial Biotechnology, Pharmaceutical and PET)

PHYSICS OF MATERIALS

OBJECTIVE:
• To make the students to understand the basics of phase diagrams and various materials preparation techniques
• To equip the students to have a knowledge on different types of electron theory, basics of quantum mechanics and about superconductors
• To introduce the physics of semiconducting materials and applications of semiconductors in device fabrication
• To familiarize the students with the theory and applications of magnetic and dielectric materials
• To provide the students a sound platform towards learning about advanced materials and their applications.

UNIT I PREPARATION OF MATERIALS

UNIT II ELECTRICAL AND SUPERCONDUCTING MATERIALS
UNIT III SEMICONDUCTING MATERIALS

UNIT IV DIELECTRIC AND MAGNETIC MATERIALS

UNIT V NEW MATERIALS AND APPLICATIONS

OUTCOME:
On completion of the course, the students will be able to
• acquire knowledge of phase diagram, and thin film and nanomaterial preparation techniques
• familiarize with conducting materials, basic quantum mechanics, and properties and applications of superconductors.
• gain knowledge on semiconducting materials based on energy level diagrams, its types, temperature effect. Also, fabrication methods for semiconductor devices will be understood.
• realize with theories and applications of dielectric and ferromagnetic materials
• familiarize with ceramics, composites, metallic glasses, shape memory alloys, biomaterials and their important applications.

REFERENCES:

CY7255 CHEMISTRY FOR TECHNOLOGISTS

OBJECTIVE
• The students should be conversant with
• boiler feed water requirements, water treatment techniques,
• Applications of oil and its properties, principles of different chemical analysis.
• Different kinds of preparations of important chemicals.

L T P C
3 0 0 3
OUTCOME
- Will be familiar with boiler feed water requirements, water treatment techniques.
- Will know the oil and its properties, principles of different chemical analysis.
- Will know the preparations of important chemicals.

UNIT I  WATER TECHNOLOGY  9

UNIT II  OILS, FATS, SOAPS & LUBRICANTS  9
Chemical constitution, chemical analysis of oils and fats – free acid, saponification and iodine values, definitions, determinations and significance. Soaps and detergents - cleaning action of soap. Lubricants - definition, characteristics, types and properties – viscosity, viscosity index, carbon residue, oxidation stability, flash and fire points, cloud and pour points, aniline point. Solid lubricants – graphite and molybdenum disulphide.

UNIT III  CHEMICAL ANALYSIS – AN ANALYTICAL INSIGHT  9

UNIT IV  DYE CHEMISTRY  9
Witt’s theory and modern theory of colors – synthesis of methyl red, methyl orange, congo red, malachite green, p-rosaniline, phenolphthalein, fluorescence, eosin dyes.

UNIT V  CHEMICALS AND AUXILIARIES  9

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS
CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

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

UNIT II       PROJECTION OF POINTS, LINES AND PLANE SURFACES
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 trapezoidal 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
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.

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

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

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)
Introduction to drafting packages and demonstration of their use.

L=45+T=30, TOTAL: 75 PERIODS

OUTCOMES:
On Completion of the course the student will be able to
- Perform free hand sketching of basic geometrical shapes and multiple views of objects.
- Draw orthographic projections of lines, Planes and Solids
- Obtain development of surfaces.
- Prepare isometric and perspective views of simple solids.

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.

CY7256 ORGANIC CHEMISTRY

AIM
To study the type of components in which organic reactions take place and also to know the preparation of the essential organic compounds.

OBJECTIVES
At the end of the course students will be in a position to have knowledge on various reaction mechanism, preparation of organic compounds and their properties. This will be a precursor for the study on Chemical Reaction Engineering.

UNIT I CARBOHYDRATES
Introduction – various definitions and classifications of carbohydrates – Preparation, Physical & Chemical properties, Structure and Uses of Monosaccharides (Glucose & Fructose) Interconversions – Aldo pentose to aldo hexose–Aldo hexose to aldo pentose- aldose to isomeric Ketose – Ketose to isomeric Aldose – Aldose to epimer

UNIT II HETEROCYCLIC COMPOUNDS
Preparation, Physical & Chemical properties and Uses of Pyrrole, Furan, Furfural, Tetrahydro Furan, Thiophene, Indole, Pyridine, Quinoline and Isoquinoline.
UNIT III  PREPARATION OF SYNTHETIC INTERMEDIATES  
Preparations of Benzil from benzyl aldehydes - Furyl from furfural, Vannilnine from catechol, 
Gramine from indole, N-acetyl-5- bromo indoline from indole, Salol from phenol, Alanine from 
propionic acid, Heteroauxin from indole - Uses, Preparation of Chlorampenicol - Uses

UNIT IV  SYNTHETIC ORGANIC CHEMISTRY  
Preparation and Synthetic utilities of Grignard reagent, Ethyl aceto acetate and Malonic ester.

UNIT V  PHARMACEUTICAL CHEMISTRY  
Synthesis of Malonyl urea, Phenacetin, Isoniazid, Para amino benzoic acid (PABA), Tryptophan 
Isopentaquine, chloroquine, Sulphanilamide and Sulphapyridine.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS
1. Chemistry in Engineering and Technology, Vol.2, TMH Publishing Co Ltd., New Delhi, 
   1994.

CH7261  CHEMICAL ANALYSIS LABORATORY  L T P C  0 0 4 2

(Minimum of 8 experiments to be conducted)

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

LIST OF EXPERIMENTS
1. Determination of Redwood / Saybolt numbers, kinematic viscosity and viscosity index of 
   Lubricating oils
2. Determination of flash point, fire point, cloud and pour point of oils
3. Determination of acid value and iodine value of oils
4. Determination of COD of water samples
5. Cement Analysis
   a. Estimation of silica content
   b. Estimation of mixed oxide content
   c. Estimation of calcium oxide content
   d. Estimation of calcium oxide by rapid method
6. Coal Analysis
   a. Estimation of sulphur present in coal
   b. Ultimate analysis of coal
   c. Proximate analysis of coal
7. Soap Analysis
   a. Estimation of total fatty acid
   b. Estimation of percentage alkali content
8. Flue gas analysis by Orsat's apparatus
10. Determination of calorific value using bomb calorimeter
11. Determination of nitrite in water.
OUTCOME
• Familiarization with equipment like viscometers, flash and fire point apparatus etc
• Familiarization of methods for determining COD
• Familiarization of a few simple synthetic techniques for soap

REFERENCE BOOKS
1. Environmental pollution analysis, S.M.Khopkar, New age international. 2011

GE7162 ENGINEERING PRACTICES LABORATORY
(Common to all Branches of B.E. / B.Tech. Programmes)  L  T  P  C
0  0  4  2

COURSE 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 & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICES
PLUMBING
• Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.
• Laying pipe connection to the suction side of a pump.
• Laying pipe connection to the delivery side of a pump.
• Practice in connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK
• Sawing, planing and making joints like T-Joint, Mortise and Tenon joint and Dovetail joint.

STUDY
• Study of joints in door panels and wooden furniture
• Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICES
• Basic household wiring using Switches, Fuse, Indicator and Lamp etc.,
• Stair case light wiring
• Tube – light wiring
• Preparation of wiring diagrams for a given situation.
• Study of Iron-Box, Fan Regulator and Emergency Lamp

GROUP – B (MECHANICAL AND ELECTRONICS)

3. MECHANICAL ENGINEERING PRACTICES
WELDING
• Arc welding of Butt Joints, Lap Joints, and Tee Joints
• Gas welding Practice.
• Basic Machining - Simple turning, drilling and tapping operations..
• Study and assembling of the following:
  a. Centrifugal pump
  b. Mixie
  c. Air Conditioner.

28
DEMONSTRATION ON FOUNDRY OPERATIONS.

4. ELECTRONIC ENGINEERING PRACTICES 15
• Soldering simple electronic circuits and checking continuity.
• Assembling electronic components on a small PCB and Testing.
• Study of Telephone, FM radio and Low Voltage Power supplies.

TOTAL: 60 PERIODS

COURSE OUTCOMES
• Ability to fabricate carpentry components and to lay pipe connections including plumbing works.
• Ability to use welding equipments to join the structures
• Ability to do wiring for electrical connections and to fabricate electronics circuits.

MA7357 PROBABILITY AND STATISTICS  L T P C
4 0 0 4

OBJECTIVES:
• To make the students acquire a sound knowledge in statistical techniques that model engineering problems.
• The Students will have a fundamental knowledge of the concepts of probability.

UNIT I RANDOM VARIABLES 12
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTS OF SIGNIFICANCE 12

UNIT IV DESIGN OF EXPERIMENTS 12
Completely randomized design – Randomized block design – Latin square design - $2^2$ - factorial design - Taguchi’s robust parameter design.

UNIT V STATISTICAL QUALITY CONTROL 12
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

OUTCOMES:
• Students will be able characterize probability models using probability mass (density) functions & cumulative distribution functions.
• The students can independently participate in the processes of analysis, planning, formulating strategies of development, decision-making, governing and management, and independent making of tactical and strategic decisions related to the statistics.

[Attested]

DIRECTOR

Centre For Academic Courses
Anna University, Chennai-600 025.
TEXT BOOKS:

REFERENCES:

AS7302 PETROLEUM CHEMISTRY

AIM
To take an overview of downstream petroleum industry.

OBJECTIVES
To get acquainted with the various standards for the analysis s of petroleum products

UNIT I
Composition of Petroleum – separation by molecular weight, type; Composition maps; Petroleum analysis and evaluation – ASTM evaluation, spectroscopic methods

UNIT II
Metals and heteroatom’s in heavy crude oil – heteroatom’s concentrations, structure of heteroatom functions; Asphaltenes and structure of petroleum

UNIT III
Thermal chemistry of petroleum constituents – visbreaking, coking, hydro treating, hydro cracking

UNIT IV
Heavy oil up gradation processes- carbon rejection, hydrogen addition; Hydro cracking reactions, catalysts, process configurations

UNIT V
Instability of petroleum products – distillate and residual products; Incompatibility in refining Operations

TOTAL : 45 PERIODS

TEXT BOOK

REFERENCE
AIM
To understand the principles and applications of fluid mechanics and mechanical operations.

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

UNIT I
PROPERTIES OF FLUID
9
Newtonian fluids; Classification of fluid motion; Fluid statics – equilibrium of fluid elements; pressure variation in a static fluid; Differential analysis of fluid motion – continuity, Euler’s and Bernoulli equation.

UNIT II
FLOW THROUGH PIPES & BOUNDARY LAYER CONCEPTS
9
Reynolds number regimes; Flow through pipes – pressure drop under laminar and turbulent flow conditions; boundary layer concepts; different types of flowmeters; Valves, pumps, compressors – characteristics and sizing; Agitation and Mixing.

UNIT III
SIZE ANALYSIS
9
General characteristics of solids, techniques of size analysis; Laws of size reduction, equipments for size reduction.

UNIT IV
FLOW THROUGH FLUIDIZED BEDS
9
Flow over a sphere – friction and pressure drag; Flow through fixed and fluidized beds. Filtration – batch and continuous, filtration equipments – selection, operation.

UNIT V
CLASSIFICATION
9
Screening, gravity separation - sedimentation, thickening, elutriation, classifiers; Centrifugal separation - continuous centrifuges, cyclones and hydro cyclones, electrostatic and magnetic separators.

TEXT BOOKS

REFERENCES

OBJECTIVE:
The objective of this course is to inculcate in the student the ability to analyze any problem in a simple and logical manner and to predict the physical phenomena and thus lay the foundation for engineering applications.
UNIT I STATICS OF PARTICLES

UNIT II EQUILIBRIUM OF RIGID BODIES

UNIT III DISTRIBUTED FORCES
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Center of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies , Determination of Centroids of Volumes by Integration. Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates , Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV FRICTION

UNIT V DYNAMICS OF PARTICLES

OUTCOMES:
• Upon completion of this course, students will be able to construct meaningful mathematical models of physical problems and solve them.

TEXT BOOK

REFERENCES
AIM
To know the principle and importance of various analytical instruments used for the characterization of various materials.

OBJECTIVES
To have thorough understanding of theory, instrumentation and applications of analytical equipments used in industries for testing quality of raw materials, intermediates and finished products.
To know the importance of analytical instrumentation during the purification, compounding and formulating the finished product.

OUTCOME
To get knowledge in different analytical techniques and apply them to analyze the chemical and petroleum products explored.

UNIT I  INTRODUCTION TO SPECTROSCOPIC METHODS OF ANALYSIS
9
Electromagnetic radiation - Various ranges, Dual properties, Various energy levels, Interaction of photons with matter, absorbance & transmittance and their relationship, Permitted energy levels for the electrons of an atom and simple molecules, Jablonski diagrams, Various electronic transitions in organic and inorganic compounds effected by UV and Visible radiations, Various energy level diagrams of saturated, unsaturated and carbonyl compounds, excitation by UV and Visible radiations, Choice of solvents, cut off wavelengths for solvents, Effects of auxochromes and effects of conjugation on the absorption maxima, Different shifts of absorption peaks (Bathochromic, hypsochromic, hypochromic, hyperchromic),

UNIT II  UV AND VISIBLE SPECTROSCOPY
9
Qualitative Spectroscopy- Lamda max and epsilon max rules, Woodward -Fieser rules for the calculation of absorption maxima (Lamda max) for dienes and carbonyl compounds, Fieser and kuhn rules - Instrumentation for UV and Visible spectrophotometer (source, optical parts and detectors)-Applications of UV and Visible spectroscopy.

UNIT III  QUANTITATIVE SPECTROSCOPY
9
Beer-Lambert’s law, Limitations, Deviations (Real, Chemical, Instrumental), Estimation of inorganic ions such as Fe, Ni and estimation of Nitrite using Beer-Lambert’s Law. Multicomponent analysis (no overlap, single way overlap and two way overlap), Photometric titration (Experimental set-up and various types of titrations and their corresponding curves).

UNIT IV  IR SPECTROSCOPY
9
Theory of IR spectroscopy, various stretching and vibration modes for diatomic and triatomic molecules (both linear and nonlinear), various ranges of IR (Near, Mid, Finger print and Far) and their usefulness, Instrumentation (Only the sources and detectors used in different regions), sample preparation techniques. Qualitative analysis of alkanes, alkenes and carbonyl compounds.

UNIT V  ATOMIC SPECTROSCOPY
9
Atomic absorption spectrophotometry: Principle, Instrumentation (Types of burners, Types of fuels, Hollow cathode lamp, Chopper only) and Applications, Various interferences observed in AAS (Chemical, radiation and excitation)
Flame photometry: Principle, Instrumentation, quantitative analysis (Standard addition method and internal standard method) and applications
Differences between AAS and FES.

REFERENCES

EE7254 PRINCIPLES OF ELECTRICAL AND ELECTRONICS ENGINEERING

OBJECTIVES:
To impart knowledge on
• Electric circuit laws, single and three phase circuits and wiring
• Working principles of Electrical Machines
• Various electronic devices and measuring instruments

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

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

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

UNIT IV ELECTRONIC DEVICES & CIRCUITS

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

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

REFERENCES

EE7312 ELECTRICAL ENGINEERING LABORATORY FOR TECHNOLOGISTS

OBJECTIVES
To provide the practical knowledge and control methods of electrical machines

OUTCOMES
To impart practical knowledge on
I. Characteristics of different machines
II. Method of speed control of machines
III. Measurement of various electrical parameters.
   1. Study of Starters
   2. Power Measurements in Three-Phase Circuits
   3. Speed Control of DC Motor
   4. Load Test on DC Shunt Motor
   5. OCC & Load Test on DC Shunt Generator
   7. OC and SC Test on Single-Phase Transformer
   8. Load Test on Single-Phase Transformer
   9. Load Test on Single-Phase Induction Motor
   10. Load Test on Three-Phase Induction Motor
   11. Load Characteristics of Alternator.

TOTAL : 60 PERIODS

AS7313 FLUID MECHANICS AND MECHANICAL OPERATIONS LABORATORY

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

OUTCOME:
Use variable area flow meters and variable head flow meters
Analyze the flow of fluids through closed conduits, open channels and flow past immersed bodies Select pumps for the transportation of fluids based on process conditions/requirements and fluid properties.
Determine work index, average particle size through experiments by crushers, ball mill and conducting sieve analysis.
Design size separation equipments such as cyclone separator, sedimentation, Filters etc.
LIST OF EXPERIMENTS - Phase - I
1. Calibration of constant and variable head meters
2. Open drum orifice and draining time
3. Flow through straight pipe
4. Flow through annular pipe
5. Flow through helical coil and spiral coil
6. Characteristic curves of pumps
7. Pressure drop studies in packed column

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

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

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

TOTAL : 60 PERIODS

AS7401 CHEMICAL ENGINEERING THERMODYNAMICS
AIM
To study the basic concepts involved in Thermodynamics and their application

OBJECTIVE
• Students will learn heat and work effects associated with process, PVT behavior of fluids, laws of thermodynamics and their application, Phase and Reaction equilibrium.
OUTCOME

• Evaluate the thermodynamic properties of fluids.
• Analyze the feasibility of systems/devices.
• Calculate chemical reaction rate and equilibrium composition.

UNIT I  ZEROTH AND FIRST LAW OF THERMODYNAMICS  12
Definitions and Concepts, Scope of Thermodynamics, Zeroth law; Temperature scales; Equations of state for ideal and real gases; First law and internal energy; First law for the non flow and flow systems; Enthalpy and heat capacity; Limitations of first law.

UNIT II  SECOND LAW OF THERMODYNAMICS  12
Statements of the second law of thermodynamics; Carnot cycle and Carnot theorems; Thermodynamic temperature scale; Entropy and its calculation; Clausius Inequality; Applications of the second law.

UNIT III  THERMODYNAMIC FORMULATIONS  12
Measurable quantities; Basic energy relations, Maxwell relations, Thermodynamic formulations to calculate enthalpy, internal energy and entropy as a function of pressure and temperature; Formulations involving C_p and C_v; Complex thermodynamic formulations, Thermodynamic properties of an ideal gas, entropy change in reversible and irreversible process.

UNIT IV  THERMODYNAMIC PROPERTIES OF REAL GASES  12
PVT behavior of fluids; Mathematical representation for PVT behavior; Generalized compressibility factor correlation; Generalized equation of state; Partial molar properties; Chemical potential, fugacity and fugacity coefficient for pure species and species in solution; Residual properties; Properties of solutions; ideal solutions; Excess properties; Gibbs free energy models; Henry’s law.

UNIT V  PHASE EQUILIBRIA AND CHEMICAL EQUILIBRIA  12
Criteria for equilibrium between phases in multi component non- reacting systems; Applications of phase rule; Qualitative behavior of Vapor- liquid equilibrium in binary and multicomponent system; Chemical Reaction Equilibria – Reaction coordinate; Criteria for chemical equilibria; Equilibrium constant; Equilibrium compositions of homogeneous gas and liquid phase reactions.

TOTAL: 60 PERIODS

TEXT BOOK

REFERENCES
AIM
To understand a reservoir and know its properties.

OBJECTIVES
To learn about basic rock and fluid properties relevant to petroleum reservoir.
To understand the causes of variation in the behavior of rocks and fluids.
To understand the drive mechanism of a reservoir

UNIT I RESERVOIR FLUID BEHAVIOR AND PROPERTIES

UNIT II ANALYSIS OF RESERVOIR FLUID AND ROCK PROPERTIES

UNIT III FUNDAMENTALS OF RESERVOIR FLUID FLOW

UNIT IV RECOVERY MECHANISM AND MATERIAL BALANCE

UNIT V WATER FLOODING AND VAPOR LIQUID PHASE EQUILIBRIUM

TOTAL : 45 PERIODS

REFERENCES

OBJECTIVES
To acquire a 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

OUTCOME
Understand the fundamentals of units and stoichiometric equations. Write material balance for different chemical process. Understand the fundamentals of ideal gas behavior and phase equilibria. Write energy balance for different chemical process.
UNIT I
Units, dimensions and conversion; Chemical & Petrochemical Process variables and properties; Stoichiometric Equations, Degrees of freedom

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

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

UNIT IV

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

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

ME7251 BASIC MECHANICAL ENGINEERING

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

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

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

UNIT II HEATING AND EXPANSION OF GASES
Expressions for work done, Internal energy and heat transfer for Constant Pressure, Constant Volume, Isothermal, Adiabatic and Polytropic processes-Derivations and problems; Free
expansion and Throttling process.

UNIT III AIR STANDARD CYCLES
Carnot cycle; Stirlings cycle; Joule cycle; Otto cycle; Diesel cycle; Dual combustion Cycle- Derivations and problems.

UNIT IV I.C. ENGINES, STEAM AND ITS PROPERTIES AND STEAM TURBINES
Engine nomenclature and classification; SI Engine; CI Engine; Four Stroke cycle, Two stroke cycle; Performance of I.C.Engine; Brake thermal efficiency; Indicated Thermal Efficiency, Specific fuel consumption.
Steam - Properties of steam; Dryness fraction; latent heat; Total heat of wet steam; Dry steam; Superheated steam. Use of steam tables; volume of wet steam, volume of superheated steam; External work of evaporation; Internal energy; Entropy of vapour, Expansion of vapour, Rankine cycle.
Steam turbines – Impulse and Reaction types - Principles of operation.

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

TEXT BOOKS

REFERENCES
5. Kothandaraman and Dhomkundwar,”: A course in Thermal Engineering (SI Units)”, Dhanpat Rai and Sons, Delhi (2001)

ME7262 MECHANICAL ENGINEERING LABORATORY

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

OUTCOME
Students will be able to understand Power-generating units such as engines and operate IC engines and conduct tests. They will be able to appreciate the theory behind the functioning of engines. Material properties, their behavior under different kinds of loading and testing can be visualized.
LIST OF EXPERIMENTS
1. Port timing diagram
2. Valve timing diagram
3. Study of 2,4 stroke I C Engines
4. Load test on 4-stroke petrol engine
5. Performance test on 4-stroke single cylinder diesel engine
6. Performance test on 4-stroke twin cylinder diesel engine
7. Heat balance test on diesel engines
8. Tension test
9. Compression test
10. Deflection test
11. Hardness test (Rockwell and Brinell)
12. Spring test
13. Torsion test
14. Impact test

TOTAL : 60 PERIODS

* Minimum 10 experiments shall be offered.

AS7412 ORGANIC CHEMISTRY LABORATORY FOR PETROCHEMICAL ENGINEERS LT P C 0 0 4 2

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

OUTCOME:
Conduct simple experiments to identify the functional groups
Prepare derivatives for aldehydes, ketones, sugars, amine and phenol
To separate organic mixtures
To carry out recrystallization

LIST OF EXPERIMENTS
1. Identification and characterization of various functional groups by their characteristic reactions: a) alcohol, b) aldehyde, c) ketone, d) carboxylic acid, e) phenol f) primary, secondary and tertiary amines
2. Preparation of solid derivatives: a) 2,4 tri nitro phenyl hydrazone for aldehydes and ketones, b) Osazone for sugars, c) acetyl and benzoyl derivatives for amine and phenol d) diazotization of aromatic amine
3. Preparation of Methyl red and Fluorescein
4. Separation of organic mixtures: a) aldehyde and acid, b) amine and phenol
5. Recrystallization of benzoic acid and acetonilide
6. Preparation of simple pharmaceuticals a) acetonilide, b) methyl salicylate, c) aspirin
7. Detection of peroxide in ether and its removal

TOTAL : 60 PERIODS

REFERENCE
2. Practical chemistry, V K Ahluwalia, University press. 2011
4. Practical Organic Chemistry by Dey and Raman
AIM
To know the knowledge of petroleum refining process.

OBJECTIVES
To understand the nature of hydrocarbon reservoirs.
To be familiar with pressure transient analysis.

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

UNIT II
Desalting of crude, pipe still furnaces, preflashing operation, Atmospheric and vacuum distillation units, different types of Reflux arrangements, Calculation of tray requirement for ADU column. Test methods and specifications: Distillation, Aniline point, Reid vapour pressure, Smoke point, flash point fire point, Carbon residue, viscosity and viscosity index, refractive index, Copper & silver strip corrosion, Octane No, Cetane No, Sulphur content, Calorific value, Total acid number, oxidation stability, cloud point, pour point etc.

UNIT III
Thermal conversion Processes: Thermal cracking processes – mechanism, applications e.g. visbreaking, thermal cracking, coking operations, Catalytic Conversion Processes : Catalytic cracking processes, Different FCC operating modes, Catalytic reforming operations, Hydro cracking, Simple process calculations.

UNIT IV

UNIT V
Finishing & Treatment processes: Different Hydro treatment (e.g. Hydro desulfurization) processes, Merox process, Doctor’s sweetening, Smoke point improvement, etc. Simple process calculations Alternative fuels, Production and Specifications: Synthetic gasoline, Bio Diesel, Ethanol, Automotive LPG

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
AIM
The main of learning this subject is that student will be able to understand the basics of Natural Gas engineering techniques.

OBJECTIVES
The objective of studying this subject is that student will be understanding 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

TOTAL : 45 PERIODS

TEXT BOOK

REFERENCE :
AIM
To learn heat transfer by different modes of heat transfer and to develop skills of the students in the area of Mass Transfer operation

OBJECTIVES
Students gain knowledge in various heat transfer and mass transfer operations in process engineering and also to design heat transfer and mass transfer equipments

UNIT I
12
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; Radiation heat transfer - Black body radiation, Emissivity, Stefan - Boltzman law, Plank’s law, radiation between surfaces.

UNIT II
12

UNIT III
12
Theory of evaporation - single effect and multiple effect evaporation - Design calculation for single and multiple effect evaporation. 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

UNIT IV
12
Introduction to mass transfer operations; Molecular diffusion in gases, liquids and solids; diffusivity measurement and prediction; multi-component diffusion. theories of mass transfer, , relationship between individual and overall mass transfer coefficients. Stage-wise and differential contractors. Gas Absorption and Stripping – Equilibrium; material balance; limiting gas-liquid ratio; tray tower absorber - calculation of number of theoretical stages,

UNIT V
12
Principle of distillation - flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by Mc.Cabe - Thiele method and Ponchan - Savarit method, Introduction to multi-component distillation, azeotropic and extractive distillation. Liquid - liquid extraction - solvent characteristics-equilibrium stage wise contact calculations for batch and continuous extractors

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
GE7351 ENGINEERING ETHICS AND HUMAN VALUES

OBJECTIVES
• To emphasise into awareness on Engineering Ethics and Human Values.
• To understand social responsibility of an engineer.
• To appreciate ethical dilemma while discharging duties in professional life.

UNIT I HUMAN VALUES

UNIT II ENGINEERING ETHICS

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime -the challenger case study.

UNIT IV ENGINEER’S RIGHTS AND RESPONSIBILITIES

UNIT V GLOBAL ISSUES
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors - moral leadership-Sample code of conduct.

TOTAL : 45 PERIODS

OUTCOMES
• Students will have the ability to perform with professionalism , understand their rights, legal, ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

TEXT BOOKS

REFERENCES
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi,
CH7561 HEAT TRANSFER LABORATORY L T P C 0 0 4 2

OBJECTIVES
Students develop a sound working knowledge 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

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

*Minimum 10 experiments shall be offered

TOTAL : 60 PERIODS

OUTCOMES
Determine Heat transfer co-efficient and evaluate performance of different types of equipments including cooling towers, tray dryers, pan evaporator, packed bed, heat exchangers, condensers, helical coils and agitated vessels

AS7511 PETROLEUM TESTING LABORATORY L T P C 0 0 4 2

AIM:
To introduce various methods of analysis by using instruments and analytical equipment to determine various physical properties of petroleum and petroleum products

OBJECTIVES:
On completion of the course, the students should be conversant with the theoretical principles and experimental procedures for quantitative estimation.
LIST OF EXPERIMENT
1. Determination of flash point.
2. Carbon residue determination of petroleum products.
3. Distillation of crude oil.
4. Determination of viscosity capillary viscometer.
5. Density of crude oil by hydrometer.
6. Pour point of crude oil and petroleum products.
7. Determination of calorific value of fuels.
8. Determination of refractive index of the petroleum products.
11. Water content in crude oil.
12. Moisture content in crude oil and products.
13. BS&W in crude oil.

TOTAL : 60 PERIODS

LIST OF EQUIPMENT
1. Flash point apparatus.
2. Centrifuge.
3. Dean and Stark Apparatus.
4. API standard distillation apparatus.
5. Capillary Viscometer.
7. Bomb calorimeter.
8. Refractometer.
10. Glass wares, balance, hot plate and heating mantle.
11. Pour Point Apparatus.

AS7603 PETROLEUM REFINING – II

AIM
To know the processes involved in refining of petroleum products.

OBJECTIVES
Know surface facility equipment and facilities for production and separation of hydrocarbons.
Knowledge of different types of bottom hole production tools and their utility.
Understanding of multiphase flows and their equations for production operations.

UNIT I CRACKING

UNIT II CATALYTIC REFORMING
UNIT III ALKYLATION AND ISOMERIZATION 9

UNIT IV COKING 9
Methods of Petroleum Coke Production – Koppers, Thermal Cracking, Delayed Coking, Fluid Coking and Contact Coking. Hydro Cracking - principles, reactions in Hydro Cracking, Catalyst, Hydro Cracking Reaction Conditions, Iso Max Processes and Hydro Desulphurization Processes.

UNIT V ASPHALT TECHNOLOGY 9

TEXT BOOKS

REFERENCES

AS7602 PETROCHEMICALS L T P C 4 0 0 4

AIM
To know about various processes involved in petroleum products.

OBJECTIVES
To develop understanding of the principles, techniques, standard tools of process optimization.
To formulate multi objective optimization problem with and without constraints based on process requirements.

UNIT I Overview of petrochemical industrial Growth in India, Economics, Feedstock Selection for Petrochemicals 12

UNIT II Steam reforming, Hydrogen, Synthesis gas, cracking of gaseous and liquid for stocks, Olefins, Diolifins, Acetylene and Aromatics and their separation. 12

UNIT III Alkylation, Oxidation, Dehydrogenation, Nitration, Chlorination, Sulphonation and Isomerization 12

UNIT IV Chemicals from synthesis gas, Olefins, Diolefins, Acetylene and Aromatics 12
UNIT V
Modes and techniques, Production of Polyethylene, PVC, Polypropylene, SAN, ABS, SBR, Polyacrylonitrile, Polycarbonates, Polyurethane, Nylon, PET

TOTAL : 60 PERIODS

REFERENCES

AS7601 CATALYTIC REACTION ENGINEERING

AIM
To impart knowledge to design different types of chemical reactors

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

UNIT I CHEMICAL KINETICS AND IDEAL REACTORS
Rate equation, elementary, non-elementary reactions, theories of reaction rate and Prediction; Design equation for constant and variable volume batch reactors, Design of continuous reactors - stirred tank and tubular flow reactor

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

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

UNIT IV BASICS OF NON-IDEAL FLOW
The residence time distribution as a factor of performance; residence time functions and relationship between them in reactor; basic models for non-ideal flow; conversion in non-ideal reactors

UNIT V HETEROGENEOUS NON CATALYTIC REACTIONS
Fluid solid non catalytic reactions . rate controlling steps; time for complete conversion for single and mixed sizes, fluidized and static reactors. Kinetics of fluid –fluid reactions, Absorption combined with chemical reactions; mass transfer coefficients and kinetic constants; application of film, penetration and surface renewal theories; Hatta number and enhancement factor for first order reaction, tower reactor design.

TOTAL : 60 PERIODS

TEXT BOOKS
COURSE DESCRIPTION
This course aims to help the students acquire the employability skills necessary for the workplace situations. It also attempts to meet the expectations of the employers by giving special attention to language skills, presentation skills, group discussion skills and soft skills. This will be achieved through expert guidance and teaching activities focusing on employability skills.

COURSE OBJECTIVES
• To enhance the employability skills of students with a special focus on presentation skills, group discussion skills and interview skills
• To help them improve their reading skills, writing skills, and soft skills necessary for the workplace situations
• To make them employable graduates

CONTENTS
UNIT I READING AND WRITING SKILLS
Reading: skimming & scanning strategies – note making skills – interpreting visual material (charts & tables) – critical reading – fast reading necessary for reading letters & files - preparing job applications - writing covering letter and résumé - applying for jobs online - email etiquette – writing official letters (placing an order, letters to consumers, etc.) writing reports – collecting, analyzing and interpreting data

UNIT II SOFT SKILLS

UNIT III PRESENTATION SKILLS
Preparing slides with animation related to the topic – organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentation

UNIT IV GROUP DISCUSSION SKILLS
Participating in group discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying – GD strategies (expressing opinions, accepting or refusing others opinions, turn taking) – activities to improve GD skills – viewing recorded GD - mock GD

UNIT V INTERVIEW SKILLS
LEARNING OUTCOMES
- Students will be able to make presentations and participate in group discussions with high level of self-confidence.
- Students will be able to perform well in the interviews
- They will have adequate reading and writing skills needed for workplace situations

TOTAL : 45 PERIODS

REFERENCES:

EXTENSIVE READING

WEB RESOURCES
1. www.humanresources.about.com
2. www.careerride.com

AS7612  MASS TRANSFER LABORATORY FOR PETROCHEMICAL ENGINEERS   L T P C  0 0 4 2

AIM
To impart knowledge on mass transfer by practice

OBJECTIVES
Students develop a sound working knowledge on different types of mass transfer equipments.

OUTCOME
Acquiring knowledge in separation of petroleum products using various distillation techniques

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
10. Demonstration Gas – liq Absorption

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

Minimum 10 experiments shall be offered.

TOTAL : 60 PERIODS

AS7611  COMPUTATIONAL PROGRAMMING IN CHEMICAL ENGINEERING
LABORATORY FOR PETROCHEMICAL ENGINEERS  LT P C
0 0 4 2

OBJECTIVES
Students will solve chemical engineering problems from core courses using C and MATLAB programming and also using computational tools like Excel and Aspen.

OUTCOME:
Able to solve chemical engineering problems using C and MATLAB programming and Microsoft Excel software. Analyse and estimate the physical properties of data bank and non data bank components; calculate bubble and dew points and generate T-xy and P-xy diagram by simulating flash drum using ASPEN PLUS Process Simulator.

Programming in C
C programs will be written to solve problems from core courses of chemical and petrochemical engineering.

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

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

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

Evaluation
This lab course will have two or three online assessment tests and an online end semester examination in the Process Simulation Laboratory and assignments in all the above four units.

TOTAL : 60 PERIODS

CH7651  PROCESS INSTRUMENTATION DYNAMICS AND CONTROL  LT P C
3 0 0 3

OBJECTIVES
To introduce dynamic response of open and closed loop systems, 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, application to solve ODEs. Open-loop systems, first order systems and
their transient response for standard input functions, first order systems in series, linearization
and its application in process control, second order systems and their dynamics; transportation
lag.

UNIT III  CLOSED LOOP SYSTEMS  9
Closed loop control systems, development of block diagram for feed-back control systems,
servo and regulatory problems, transfer function for controllers and final control element,
principles of pneumatic and electronic controllers, transient response of closed-loop control
systems and their stability.

UNIT IV  FREQUENCY RESPONSE  9
Introduction to frequency response of closed-loop systems, control system design by frequency
response techniques, Bode diagram, stability criterion, tuning of controller settings

UNIT V  ADVANCED CONTROL SYSTEMS  9
Introduction to advanced control systems, cascade control, feed forward control, Smith predictor
controller, control of distillation towers and heat exchangers, introduction to computer control of
chemical processes.

TOTAL : 45 PERIODS

OUTCOME:
Understand the prerequisites of control strategies and design different process control systems
Evaluate the suitable controllers for different chemical process.
Analyze and tune the control systems unto stability
Understand the mechanism of advance control systems

TEXT BOOKS
York, 2008.

REFERENCES

AS7701  PETROLEUM EQUIPMENT DESIGN  L T P C
3 0 0 3

AIM
To give practice to students to design in detail different process equipments used in petroleum
industry.

OBJECTIVE
Students learn to do in detail process and mechanical design and engineering drawing of
different equipments generally used in petroleum industry
UNIT I  HEAT TRANSFER OPERATIONS  9
Fired heaters, Heat Exchangers, Condensers, Evaporators, Reboilers,

UNIT II  DESIGN OF PHASE SEPARATION EQUIPMENT  9
Design of physical separation equipments such as cyclones, centrifuges, thickeners, filtration equipment

UNIT III  MASS TRANSFER OPERATIONS  9
Absorption column, Distillation Column, Extraction Column, Cooling tower, Dryer, Crystallizer

UNIT IV  REACTORS AND STORAGE VESSELS  9
Packed bed Reactors, FCC units, Pressure Vessel, Storage Vessel

UNIT V  MATERIALS OF CONSTRUCTION AND PLANT LAYOUT  9
Design of Plant Layout, Pipe Lines and Pipe Layouts, Design Schematics and Presentation, Materials of Construction and Selection of process

TOTAL : 45 PERIODS

REFERENCES

GE7251  ENVIRONMENTAL SCIENCE AND ENGINEERING  L T P C
3 0 0 3

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

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY  14
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India.
conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

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

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

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V  HUMAN POPULATION AND THE ENVIRONMENT

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 environment at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions.
- Development and improvement in standard of living has lead to serious environmental disasters.
TEXT BOOKS:

REFERENCES:

AS7711 PROCESS CONTROL LABORATORY FOR PETROCHEMICAL ENGINEERS

OBJECTIVES
Students will gain the hands on training about the control systems

OUTCOME:
Understand the prerequisites of control strategies and design different process control systems
Evaluate the suitable controllers for different chemical & Petrochemical process.
Analyse and tune the control systems unto stability

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

*Minimum 10 experiments shall be offered.

TOTAL : 60 PERIODS
OBJECTIVES
Students develop a sound working knowledge on different types of reactors.

LIST OF EXPERIMENTS*
1. Kinetic studies in a Batch reactor
2. Kinetic studies in a Plug flow reactor
3. Kinetic studies in a CSTR
4. Kinetic studies in a Packed bed reactor
5. Kinetic studies in a PFR followed by a CSTR
6. RTD studies in a PFR
7. RTD studies in a Packed bed reactor
8. RTD studies in a CSTR
9. Studies on micellar catalysis
10. Study of temperature dependence of rate constant using CSTR.
11. Kinetic studies in Sono chemical reactor
12. Batch reactive distillation
13. Kinetics of photochemical reaction
14. Demonstration of heterogeneous catalytic reaction
15. Demonstration of gas-liquid reaction

EQUIPMENT REQUIRED
1. BATCH REACTOR
2. Plug flow reactor
3. CSTR
4. Sono-chemical reactor
5. Photochemical reactor
6. Packed bed reactor
*Minimum 10 experiments shall be offered.

TOTAL : 60 PERIODS

OUTCOMES
Understand rate equation for different types of reactors.
Design experiments in kinetics to determine conversion and effect of temperature on rate constant.
Assess the performance of Plug flow Mixed flow and Packed bed by studying the residence time distribution.

MA 7354
NUMERICAL METHODS

OBJECTIVES:
• To provide the mathematical foundations of numerical techniques for solving linear system, eigenvalue problems, interpolation, numerical differentiation and integration and the errors associated with them;
• To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS
Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method and by Jacobi’s method.

UNIT II INTERPOLATION AND APPROXIMATION  12
Interpolation with unequal intervals - Lagrange interpolation – Newton’s divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton’s forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT III NUMERICAL DIFFERENTATION AND INTEGRATION  12

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS  12

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS  12
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL: 60 PERIODS

OUTCOMES:
- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
- Apply numerical methods to obtain approximate solutions to mathematical problems.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyse and evaluate the accuracy of common numerical methods.

TEXT BOOKS:

REFERENCES:
AIM
To get acquainted with process design of distillation columns involving multicomponent and complex mixtures. To learn methodologies practiced in rating and designing heat transfer equipment used in refining and process industry.

OBJECTIVE
Students learn process design aspects related to distillation column, Fired Heaters, pumps and compressors

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

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

UNIT III  COLUMN DESIGN

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

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

TEXT BOOKS

TOTAL: 45 PERIODS
AIM
To emphasize the importance of time value of money in petroleum projects.

OBJECTIVES
To understand the economic and decision analysis parameters in Petroleum Engineering and Petroleum Business.
To understand the background of functioning of petroleum industry as an economic entity.

UNIT I INTRODUCTION

UNIT II CONSUMER AND PRODUCER BEHAVIOUR

UNIT III PRODUCT AND FACTOR MARKET

UNIT IV PERFORMANCE OF AN ECONOMY – MACRO ECONOMICS

UNIT V AGGREGATE SUPPLY AND THE ROLE OF MONEY

TOTAL: 45 PERIODS.

OUTCOME
Understanding of petroleum fiscal system within the context of India.

TEXT BOOKS

REFERENCES
OBJECTIVE:
This course aims at providing the required skill to apply the statistical and Linear Programming tools for engineering problems.

UNIT I TESTING OF HYPOTHESIS 12
Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi-Square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 12
Completely randomized design – Randomized block design – Latin square design - \(2^2\) factorial design.

UNIT III STATISTICAL QUALITY CONTROL 12
Control charts for measurements (and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

UNIT IV LINEAR PROGRAMMING 12

UNIT V ADVANCED LINEAR PROGRAMMING 12
Dual simplex method – Formation and using simplex method – Integer programming – Cutting plane algorithm.

OUTCOMES:
- The students will have a fundamental knowledge of the concepts of statistical inference.
- Have the knowledge of applying Linear programming tools in management problems.

TEXT BOOKS:

REFERENCES:
AIM
Students will understand the Drilling Process and Drilling Equipments.

OBJECTIVES
Students will understand the concepts and techniques used in well drilling. They will learn the design requirements of well planning and construction.

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

TEXT BOOKS

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

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

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

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

REFERENCE

AS7012 PLANT SAFETY AND RISK ANALYSIS

AIM
To get awareness on the importance of plant safety and risk analysis

OBJECTIVES
Students learn about implementation of safety procedures, risk analysis and assessment, hazard identification.

UNIT I NEED FOR SAFETY IN INDUSTRIES
Importance & objectives of safety- Safety Programmes – components and realization; Potential hazards – extreme operating conditions, toxic chemicals; safe handling

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

UNIT III PLANT HAZARDS & RISK ANALYSIS
Fire hazards- Chemical hazards, Toxic hazards, Explosion hazards, Electrical hazards, Mechanical hazards, Radiation hazards, Noise hazards-Over all risk analysis–emergency planning-on site & off site emergency planning, risk management ISO 14000, EMS models case studies. Quantitative risk assessment - rapid and comprehensive risk analysis; Risk due to Radiation, explosion due to over pressure, jet fire-fire ball.
UNIT IV  SAFETY AUDIT
Objective of safety audit- Hazard identification safety audits, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazan past accident analysis Fixborough-Mexico-Madras-Vizag Bopal analysis

UNIT V  RISK ANALYSIS TECHNIQUES
Hazard & Operability (HAZOP) studies- Hazard Analysis (HAZAN)-Fault Tree Analysis Consequence Analysis.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

AS7030  ENHANCED OIL RECOVERY  L T P C  3 0 0 3

AIM
To understand the nature of reservoirs and strategy for increasing reservoir efficiency.

OBJECTIVES
To be able to design an oil recovery technique. To be able to predict the future performance of a reservoir.

UNIT I  FUNDAMENTALS OF ENHANCED OIL RECOVERY

UNIT II  WATER FLOODING
Properties, sampling and analysis of Oil Field Water; Injection waters; Water flooding – Sweep Efficiency, Predictive Techniques, Improved Water Flood Processes, Performance of some Important Water Floods.

UNIT III  ENHANCED OIL RECOVERY OPERATIONS-1
Flooding – miscible, CO2, polymer, alkaline, surfactants, steam;

UNIT IV  ENHANCED OIL RECOVERY OPERATIONS-2
Gas injection, in-situ combustion technology, microbial method

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UNIT V PROBLEMS IN ENHANCED OIL RECOVERY

Precipitation and Deposition of Asphaltenes and Paraffins, Scaling Problems, Formation of Damage Due to Migration of Fines, Environmental factors.

REFERENCES

AS7011 PETROLEUM PRODUCTION ENGINEERING

AIM
To develop a logical built up of the various facets of the oil and gas production technology.

OBJECTIVES
An ability to understand and apply operational and maintenance of has lift wells along with surface facilities
An ability to understand and apply other methods of artificial lift systems with awareness of their advantages and disadvantages

OUTCOME
An ability to understand and apply need of stimulation techniques and their types for enhancement in production

UNIT I
Petroleum production system, properties of oil and natural gas, reservoir deliverability

UNIT II
Wellbore performance, choke performance, well deliverability, forecast of well production, production decline analysis

UNIT III
Equipment design and selection – well tubing, separation and transportation systems

UNIT IV
Artificial lift methods - sucker rod pumping, gas lift, artificial lift methods

UNIT V
Production enhancement – well problem identification, matrix acidizing, hydraulic fracturing, production optimization

REFERENCE
AIM
To sensitize and create an awakening among the course participants on adhering to principles of healthy living and instilling the style modifications.

OBJECTIVE
To cause behavioral changes in the learning clientele and creating the necessary psycho sociological ramifications, motivating the participants to adopt a healthy life style.

UNIT I  IMPORTANCE OF MICRONUTRIENTS AND ADHERING TO LOW GLYCEMIC INDEX FOODS

UNIT II  IMMUNIZATION SCHEDULING – NEED FOR ADHERENCE
Protein calorie malnutrition –Importance of intake of folic acid supplements to prevent genital abnormalities –Necessity to avoid early marriage –Need for various immunizations their dosage schedules-Need to immunize adolescent and girl children to prevent cervical cancer.

UNIT III  LIFE SAVING CHILD SURVIVAL STRATEGIES
Drastically cutting down mortality and morbidity –Causative factors of dehydration –Warning symptoms –Need to administer life saving Oral Rehydration Salt solution (ORS) –Methodology of preparing ORS solution –Importance of zinc as an additive.

UNIT IV  STRATEGIES FOR INCREASING HDL AND LOWERING LDL CHOLESTEROL
Healthy fats –Need to avoid saturated and trans fats –Optimum value of HDL and LDL cholesterols –Need to lower triglycerides –Ways of reducing bad LDL cholesterol –Role of Thyroid Simulating Hormone (TSH) –Importance of mental health –Positive and optimistic outlook on life –Pronic breathing as a stress relief mechanism.

UNIT V  ORGANIC FARMING – BIOPESTICIDES PRODUCTION – WEALTH FROM WASTE
Eco friendly organic vegetables and fruits –Biopesticides –Neem based  –Use of BIOBLOOM in conversion of waste into Bio manure –Healthy equilibrium between work and rest –Maintaining good postures to avoid back and neck pain syndrome –Principles of ERGONOMICS –Gender sensitization –Respecting each others domain and contribution.

TOTAL : 45 PERIODS

REFERENCE

AS7021  TECHNICAL ANALYSIS – AN ANALYTICAL INSIGHT

AIM
The elective will enable the students to have a good grasp over the principles and generalizations of Technical analysis.

OBJECTIVE
The study of the elective will enhance the cognitive domain of the Learners and motivate them to extrapolate the principles of analysis to their analytical skills and to make an indelible

TOTAL : 45 PERIODS

REFERENCE
evergreen impression in their minds about the logical, sequential, stepwise approach to analysis.

UNIT I  TYPES OF ANALYSIS – UNDERLYING PRINCIPLES

Purity of simple sugars – Glycemic Index and its importance – Principles underlying Bertrand’s estimation of percentage purity of glucose – Estimation of percentage purity of aniline – Underlying principles

UNIT II  COAL AND FERTILZER ANALYSIS – BASIC PRINCIPLES

Correlation between thermal energy and fixed carbon – Estimation of Sulphur in coal – Fluidized bed technology to reduce sulphur – Estimation of Nitrogen in soil and nitrogenous fertilizers – Analysis of coal for grading

UNIT III  CLASSIFICATION OF CEMENT – OPTIMUM PARAMETER FOR QUALITY

Types of analysis of cement – Standard and Rapid method – Underlying theory behind percentage estimation of SiO₂, Mixed oxides and Calcium oxides – Optimum Quality parameter and ratios for good quality cement – Gel formation – Use of additives

UNIT IV  ANALYSIS OF OILS – PURITY CRITERIA – OILS AND GOOD HEALTH

Principles underlying estimation of acid, saponification and iodine value of an oil – Importance of increase in HDL and lowering LDL cholesterol – Optimum values for HDL and LDL cholesterol – Lowering of triglycerides – Various approaches

UNIT V  DRINKING WATER STANDARDS – STRATEGIES FOR STERILIZATIONS

Estimation of chloride, sulphate, Total dissolved solids and dissolved oxygen in a given sample of water – Principles underlying the above fundamentals and generalizations underlying determination of chemical oxygen demand – Reduction of BOD – Various strategies, Principles underlying water purification – WHO standards of drinking water.

TOTAL : 45 PERIODS

REFERENCES

AS7032  MULTICOMPONENT DISTILLATION  L T P C
3 0 0 3

AIM
To understand the concepts of Multicomponent distillation systems.

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

UNIT I  THERMODYNAMIC PRINCIPLES

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

UNIT III  MINIMUM REFLUX RATIO FOR MCD SYSTEM  

UNIT IV  VARIOUS METHODS OF MCD COLUMN DESIGN  
The Theta method of convergence – Kb method and the constant composition method – Application of the Theta method to complex columns and to system of columns – Lewis Matheson method – Stage and reflux requirements – Short cut methods and Simplified graphical procedures.

UNIT V  VARIOUS TYPES OF MCD COLUMNS  
Design of sieve, bubble cap, valve trays and structured packing columns for multi component distillation – computation of plate efficiencies.

TOTAL : 45 PERIODS

TEXT BOOKS

CH7071  ENERGY TECHNOLOGY  L T P C
3 0 0 3

OBJECTIVES
Students will gain knowledge about different energy sources

UNIT I  ENERGY  
Introduction to energy – Global energy scene – Indian energy scene - Units of energy, conversion factors, general classification of energy, energy crisis, energy alternatives

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

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

UNIT IV  BIOMASS ENERGY  
Biomass origin - Resources – Biomass estimation. Thermochemical conversion – Biological conversion, Chemical conversion – Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, integrated gasification.
UNIT V ENERGY CONSERVATION

Energy conservation - Act; Energy management importance, duties and responsibilities; Energy audit – Types methodology, reports, instruments. Benchmarking and energy performance, material and energy balance, thermal energy management.

TOTAL : 45 PERIODS

OUTCOMES
Understand conventional Energy sources, Non-conventional Energy sources, biomass sources and develop design parameters for equipment to be used in Chemical process industries. Understand energy conservation in process industries.

TEXTBOOKS

REFERENCES

AS7024 ADVANCED SEPARATION TECHNIQUES L T P C

AIM
To identify the multiple factors influencing the choice of separation techniques.

OBJECTIVES
To be able to qualitatively and quantitatively address the fundamental aspects of specialty separation processes.

UNIT I GENERAL REVIEW

UNIT II MEMBRANE SEPARATIONS
Types and choice of membranes, their merits, commercial, pilot plant polarization of membrane processes and laboratory membrane permeators, dialysis, reverse osmosis, ultra filtration, Concentration and economics of membrane operations, Design controlling factors.

UNIT III SEPARATION BY SORPTION TECHNIQUES
Types and choice of adsorbents, chromatographic techniques, Types, Retention theory mechanism, Design controlling factors ion exchange chromatography equipment and commercial processes, recent advances and economics.

UNIT IV IONIC SEPARATIONS
Controlling factors, applications, Theory mechanism and equipments for electrophoresis, dielectrophoresis and electro dialysis - commercial applications - Design considerations.
UNIT V THERMAL SEPARATION

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES

AS7014 PROCESS OPTIMIZATION

AIM
To acquaint the student with the concepts and techniques of single and multivariable optimization techniques using numerical search and analytical methods

OBJECTIVE
The student will enable to optimize the problems related to design, planning and operations involved in a chemical industry

UNIT I OPTIMISATION
Introduction; formulation of objective functions; fitting models to data; classification of functions; necessary and sufficient conditions for optimum; unimodal, multimodal functions; analytical methods lagrange multiplier methods.

UNIT II NUMERICAL METHODS
Unimodel functions; newton's quasi newton, secant methods; region elimination methods, polynomial approximation; quadratic and cubic interpolation techniques for optimum. Multimodal functions; direct methods; random, grid. Hooke's nelder and mead methods; Powell's technique; indirect methods; gradient and conjugate gradient methods; secant methods.

UNIT III LINEAR AND NON-LINEAR PROGRAMMING APPLICATIONS
Review on basic concepts of LP formulations; Simplex methods; Integer, quadratic, geometric and dynamic programming. Heat transfer and energy conservation; separation processes; fluid flow systems; reactor design and operation; large scale systems.

UNIT IV MULTIVARIABLE OPTIMIZATION WITHOUT AND WITH CONSTRAINTS
Necessary and sufficient conditions for optimum; direct search methods; indirect search methods.

UNIT V APPLICATIONS OF OPTIMIZATION
Formulation of objective functions; fitting models to data; applications in fluid mechanics, heat transfer, mass transfer, reaction engineering, equipment design, resource allocation and inventory control.
TEXT BOOKS.

REFERENCES

AS7025 CHEMICAL PROCESS MODELLING AND SIMULATION L T P C 3 0 0 3

OBJECTIVES
Students will develop suitable chemical process model to get process output

UNIT I INTRODUCTION 9
Introduction to modeling and simulation, classification of mathematical models, conservation equations and auxiliary relations.

UNIT II STEADY STATE LUMPED SYSTEMS 9
Degree of freedom analysis, single and network of process units, systems yielding linear and non-linear algebraic equations, flow sheeting – sequential modular and equation oriented approach, tearing, partitioning and precedence ordering, solution of linear and non-linear algebraic equations.

UNIT III UNSTEADY STATE LUMPED SYSTEMS 9
Analysis of liquid level tank, gravity flow tank, jacketed stirred tank heater, reactors, flash and distillation column, solution of ODE initial value problems, matrix differential equations, simulation of closed loop systems.

UNIT IV STEADY STATE DISTRIBUTED SYSTEM 9
Analysis of compressible flow, heat exchanger, packed columns, plug flow reactor, solution of ODE boundary value problems.

UNIT V UNSTEADY STATE DISTRIBUTED SYSTEM & OTHER MODELLING APPROACHES 9

OUTCOME:
Understand the fundamentals of modelling and their applications to transport/energy equations, chemical and phase equilibria kinetics etc.,
Create the mathematical models for different unit operations equipments such as stirred tank heaters, Heat exchangers, Evaporators,Reactors, distillation columns etc.,
Analyze the principles of steady state/unsteady state lumped systems and steady state/unsteady state distributed systems and can select proper equation of state for estimating component properties and process flow sheeting.

TEXT BOOKS

REFERENCES

AS7015 PROCESS PLANT UTILITIES FOR PETROCHEMICAL ENGINEERS L T P C

AIM
To understand the fundamentals and principles of main utilities required for process plants are water, steam, air & refrigerants.

OBJECTIVES
• State the principles involved during water treatment, generation of steam and its uses, refrigeration cycles.
• Describe the different equipment’s used to run the process plant with different utilities

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

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

UNIT III REFRIGERATION
Refrigeration Cycles, Methods of Refrigeration used in Industry and Different Types of Refrigerants such as Monochlorodifluoromethane, Chlorofluorocarbons and Brines. Refrigerating Effects and Liquefaction Processes.

UNIT IV COMPRESSORS AND COOLING TOWERS

UNIT V FUEL AND WASTE DISPOSAL

TOTAL: 45 PERIODS
TEXT BOOKS

REFERENCES

AS7020 SUPPLY CHAIN MANAGEMENT FOR PETROCHEMICAL ENGINEERS

L T P C
3 0 0 3

OBJECTIVES
Students will gain knowledge about practices followed in supply chain management

OUTCOMES
Understand the logistics management and supply chain network design Apply latest technology used in supply chain management.

UNIT I INTRODUCTION
6
Definition of Logistics and SCM: Evolution, Scope, Importance& Decision Phases – Drivers of SC Performance and Obstacles

UNIT II LOGISTICS MANAGEMENT
10

UNIT III SUPPLY CHAIN NETWORK DESIGN
10
Distribution in Supply Chain – Factors in Distribution network design –Design options-

UNIT IV SOURCING, AND PRICING IN SUPPLY CHAIN
9
Supplier selection and Contracts - Design collaboration - Procurement process. Revenue management in supply chain

UNIT V COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN
10
Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work. E Business & SCM. Metrics for SC performance – Case Analysis

REFERENCES
2. Logistics, David J.Bloomberg, Stephen Lemay and Joe B.Hanna, PHI 2002
AIM
To learn heat flow in condensers, cooling towers.

OBJECTIVES
To learn the thermal and stress analysis on various parts of the heat exchangers.
To analyze the sizing and rating of the heat exchangers for various applications.

UNIT I INTRODUCTION
Types of heat exchangers, shell and tube heat exchangers – regenerators and recuperators
Temperature distribution and its implications - Parts description, Classification as per Tubular
Exchanger Manufacturers Association (TEMA)

UNIT II PROCESS DESIGN OF HEAT EXCHANGERS
Heat transfer correlations, Overall heat transfer coefficient, analysis of heat exchangers – LMTD
and effectiveness method. Sizing of finned tube heat exchangers, U tube heat exchangers,
Design of shell and tube heat exchangers, fouling factors, pressure drop calculations.

UNIT III STRESS ANALYSIS
Stress in tubes – header sheets and pressure vessels – thermal stresses, shear stresses -
types of failures, buckling of tubes, flow induced vibration.

UNIT IV COMPACT AND PLATE HEAT EXCHANGER
Types- Merits and Demerits- Design of compact heat exchangers, plate heat exchangers,
performance influencing parameters, limitations.

UNIT V CONDENSERS AND COOLING TOWERS
Design of surface and evaporative condensers – cooling tower – performance characteristics.

OUTCOME
To study heat exchange in different systems.

TEXT BOOKS
1. SadikKakac and Hongtan Liu, Heat Exchangers Selection, Rating and Thermal Design,

REFERENCES
1. Robert W. Serth, Process heat transfer principles and applications, Academic press,
3. John E. Hessel greave,Compact heat exchangers: selection, design, and operation,
5. Eric M. Smith, Advances in thermal design of heat exchangers: a numerical approach:
AIM
To understand the fundamental concepts of equipment and product design.

OBJECTIVE
To teach the students basic concepts of Product Design and Process Development. Expose the students to the importance, various stages, concepts, management and prototyping of Product Design and Process Development.

UNIT I INTRODUCTION
9
Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement.

UNIT II CONCEPT GENERATION, SELECTION AND TESTING
9

UNIT III PRODUCT ARCHITECTURE
9
Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

UNIT IV INDUSTRIAL DESIGN
9
Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design-impact – design process - investigation of customer needs - conceptualization - refinement - management of the industrial design process.

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT
9
Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping – Planning for prototypes - Economic Analysis.

TOTAL : 45 PERIODS

OUTCOME
An ability to understand the concepts of manufacturing and product development.

TEXT BOOK

REFERENCES
AIM
The course gives an introduction into modeling using Computational Fluid Dynamics (CFD), which has become an indispensable tool for many engineers.

OBJECTIVE
Be able to demonstrate competence in setting up computational fluid dynamics models for some industrially important applications. This technical competence in building and conducting CFD simulations is a skill which enhances employability.

UNIT I CONSERVATION LAWS AND TURBULENCE MODELS
Governing equations of fluid flow and heat transfer – mass conservation, momentum and energy equation, differential and integral forms, conservation and non-conservation form. Characteristics of turbulent flows, time averaged Navier Stokes equations, turbulence models one and two equation, Reynolds stress, LES and DNS

UNIT II FINITE DIFFERENCE APPROXIMATION
Mathematical behaviour of PDE, finite difference operators, basic aspects of discretization by FDM, explicit and implicit methods, error and stability analysis

UNIT III FINITE VOLUME METHOD
Diffusion problems – explicit and implicit time integration; Convection-diffusion problems – properties of discretisation schemes, central, upwind, hybrid, QUICK schemes; Solution of discretised equations.

UNIT IV FLOW FIELD COMPUTATION
Pressure velocity coupling, staggered grid, SIMPLE algorithm, PISO algorithm for steady and unsteady flows

UNIT V FINITE VOLUME METHOD FOR UNSTEADY FLOWS AND IMPLEMENTATION OF BOUNDARY CONDITIONS
One-dimensional unsteady heat conduction, Discretisation of transient convection-diffusion equation, Solution procedures for unsteady flow calculations, Implementation of Inlet, outlet and wall boundary conditions, constant pressure boundary condition.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE
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
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  9
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
- Differentiate the types of disasters, causes and their impact on environment and society.
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
• Draw the hazard and vulnerability profile of India, Scenarios in the Indian context,
• Disaster damage assessment and management.

TEXTBOOKS:
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management,
   NIDM, New Delhi, 2011
   New Delhi, 2010.

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

GE7074 HUMAN RIGHTS

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

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

UNIT II

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
Human Rights of Disadvantaged People – Women, Children, Displaced persons and
Disabled persons, including Aged and HIV Infected People. Implementation of Human
Rights – National and State Human Rights Commission – Judiciary – Role of NGO’s,
Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

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

REFERENCES:
   Allahabad, 2014.
AIM

- To make the students understand the principle and application of various physical chemistry concepts

OBJECTIVE

- To acquire knowledge in the fields of electrochemistry, corrosion, phase equilibria, colloids, colligative properties towards different applications

UNIT I ELECTROCHEMISTRY 9


UNIT II CORROSION & ITS CONTROL 9

Introduction - Dry or Wet corrosion Types - Wet or Electrochemical Corrosion - Mechanism - Galvonic corrosion - Concentration Cell Corrosion - Soil Corrosion - Pitting Corrosion - intergranular corrosion - pipeline corrosion - Water line Corrosion - Factors influencing Corrosion and Corrosion Control.

UNIT III PHASE EQUILIBRIA 9

Phase - Components - Degrees of freedom - The Gibbs Phase rule - Derivation of the Phase rule - One Component system - The water System - The Sulphur System - Two Component system - Simple Eutectic System - Thermal analysis - cooling curves - Lead-Silver System - Desilverisation of Lead - Congruent and Incongruent Melting points.

UNIT IV COLLOIDS 9


UNIT V THE DISTRIBUTION LAW & COLLIGATIVE PROPERTIES 9


TOTAL : 45 PERIODS

TEXT BOOKS


REFERENCES

AIM: To have a basic understanding of a broad array of tools used in the search for and production of hydrocarbon reserves. To learn the principles of mapping a subsurface reservoir and estimating the volumetrics.

OBJECTIVE
To ensure that potential hazards are identified and mitigation measures are in place to prevent accidents.

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

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

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

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

UNIT V  SAFETY EDUCATION AND TRAINING

TOTAL : 45 PERIODS

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

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.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

AS7013 PROCESS ENGINEERING L T P C
3 0 0 3

OBJECTIVE:
- To impart knowledge on the fundamentals of Process Engineering activities in designing the oil and gas facilities.

OUTCOME:
- To get familiarized on the roles and responsibilities of a Process Design Engineer.
- Understand the Engineering Drawings used in Design.
- To know the basics of performing various Hydraulic Calculations and sizing of Equipments.
- Aware of various Design Codes & Standards used in Project.

UNIT I INTRODUCTION TO OIL AND GAS FACILITIES
Introduction to Oil and Gas Industry-Process description- Piping elements- Instruments: field instruments, control valves- Process equipments- Role of Process Engineer.
UNIT II  INTRODUCTION TO PROJECT ENGINEERING  

UNIT III  PROCESS SIMULATION AND DESIGN  
Introduction and purpose- Softwares used for Simulation, Simulation inputs- Steady state simulation- Typical operation in simulation schemes- Heat and material balance generation, Dynamic Simulation Study and its uses. Introduction to Relief and Blow down Studies, Pipeline Flow assurance Study-Steady State and Transient, Softwares used in Flow assurance Studies, Introduction to AIV/FIV studies, CFD analysis

UNIT IV  ENGINEERING DIAGRAMS  

UNIT V  FACILITIES ENGINEERING  
Process Design Basis and Design Criteria, Overview of various process equipments and its design principles: Separators, Pumps, Compressors, Heat exchangers, Absorber column, Heaters, Air coolers, Storage Tanks, Line hydraulics(Gas, Liquid and Multiphase lines)- Pump hydraulics-Control valve hydraulics, Softwares used in Equipment design (Column, Heat Exchanger etc). Introduction to various Codes and Standards followed in a PROJECT (API,TEMA,ISA etc)

TOTAL : 45 PERIODS

REFERENCES
4. ISA Standards
5. TEMA standards, Tubular Exchanger Manufacturers Association, Inc.

AS7027  CRUDE OIL TRANSPORTATION  
AIM  To understand the crude oil transportation and to learn the concepts of storage.

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

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 CHARACTERISTICS OF STORAGE VESSELS

TOTAL : 45 PERIODS

TEXT BOOKS

AS7031 EQUILIBRIUM STAGED OPERATIONS L T P C 3 0 0 3

AIM
To impart knowledge on the design of different staged operations using the concept of equilibrium

OBJECTIVES
The students will learn in detail the unifying theory and design of different staged operations like absorption, distillation, extraction and adsorption.

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
Principle of distillation - flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by Mc.Cabe - Thiele method and Ponchan - Savarit method, Total reflux, minimum reflux ratio, optimum reflux ratio. Desing of azeotropic and extractive distillation columns.

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

UNIT IV LIQUID-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 V  ADSORPTION & MEMBRANE SEPARATION PROCESS  9
Adsorption - Types of adsorption, nature of adsorbents, adsorption equilibria, effect of pressure and temperature on adsorption isotherms, Adsorption operations - stage wise operations, steady state moving bed and unsteady state fixed bed adsorbers, break through curves. Solid and liquid membranes; concept of osmosis; reverse osmosis; electro dialysis; ultrafiltration

TEXT BOOKS

REFERENCES

AS7022  TRANSPORT PHENOMENA FOR PETROCHEMICAL ENGINEERS  L T P C
AIM
To give an overview of mass, momentum and energy transport, present the fundamental equations and illustrate how to use them to solve problems.

OBJECTIVE
To describe mass, momentum and energy transport at molecular, microscopic and macroscopic level, to determine velocity, temperature and concentration profiles.

OUTCOME
Understand the similarity between heat, mass and momentum transport and their analogy. Develop the ability to formulate and solve mathematical models for physical situations. Understand the science of turbulence, its prediction through various models and their utility. Mathematical formulation of heat transfer problem and its numerical solution.

UNIT I  MOMENTUM TRANSPORT
Viscosity, temperature effect on viscosity of gases and liquids, Newton’s law, mechanism of momentum transport, shell balance method, pressure and velocity distributions in falling film, circular tube, annulus, slit.

UNIT II  ENERGY TRANSPORT
Thermal conductivity, temperature and pressure effect on thermal conductivity of gases and liquids, Fourier’s law, mechanism of energy transport, shell energy balance, temperature distribution in solids and laminar flow, with electrical, nuclear, viscous, chemical heat source, heat conduction through composite walls, cylinders, spheres, fins, slits.

UNIT III  TEMPERATURE DISTRIBUTION
Energy equations, special forms, use of equations of change, dimensional analysis of equations of change, time-smoothed equations of change, empirical expressions, temperature distribution for turbulent flow in tubes, jets.

UNIT IV  CONCENTRATION DISTRIBUTION
Diffusivity, temperature and pressure effect, Fick’s law, mechanism of mass transport, theory of diffusion in gases and liquids, shell mass balances, concentration distribution in solids and in
UNIT V  ANALOGIES BETWEEN TRANSPORT PROCESSES  

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

ME 7075  DESIGN OF PRESSURE VESSELS AND PIPING  
L  T  P  C
3  0  0  3

OBJECTIVES:
- To apply the Mathematical knowledge gained in the design of pressure vessels and piping
- To carry out the stress analysis in pressure vessels and piping.

UNIT I  INTRODUCTION

UNIT II  STRESSES IN PRESSURE VESSELS

UNIT III  DESIGN OF VESSELS
Design of Tall cylindrical self supporting process columns – Supports for short vertical vessels – Stress concentration at a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of Reinforcement – Pressure Vessel Design.

UNIT IV  BUCKLING AND FRACTURE ANALYSIS IN VESSELS
Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.
UNIT V  PIPING  
TOTAL: 45 PERIODS

OUTCOMES:  
Upon completion of this course, the students will be able to:  
- Apply the mathematical fundamentals for the design of pressure vessels and pipes.  
- Analyse and design pressure vessels and piping.

TEXT BOOK:  

REFERENCES:  

MG7451  PRINCIPLES OF MANAGEMENT  
AIM:  
To learn the different principles and techniques of management in planning, organizing, directing and controlling.  

OBJECTIVES  
- To study the Evolution of Management  
- To study the functions and principles of management  
- To learn the application of the principles in an organization

UNIT I  INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS  

UNIT II  PLANNING  

UNIT III  ORGANISING  

UNIT IV  DIRECTING  
- Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

**UNIT V CONTROLLING**

System and process of controlling – Budgetary and non-Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

**TOTAL: 45 PERIODS**

**OUTCOMES:**
- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

**TEXT BOOKS:**

**REFERENCES:**
UNIT II REQUIREMENTS AND SYSTEM DESIGN


UNIT III DESIGN AND TESTING


UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT


UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY


TOTAL: 45 PERIODS

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

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

REFERENCES:

Attested

Sajith
DIRECTOR