Programme Educational Objectives (PEO’s)

Graduates of B.Tech Chemical Engineer will

- Apply principles of mathematics, science, and engineering to analyze and solve problems encountered in chemical engineering and related areas.
- Think critically and creatively, especially about the use of technology to address local and global problems and become a socially responsible engineer by involving with community and professional organizations
- Exhibit professional, ethical codes of conduct, team work and continuous learning for catering the ever changing needs of the society

Programme Outcomes

On successful completion of the B.Tech Chemical Engineering programme,

1. Graduates will have the ability to apply the knowledge of mathematics, science and engineering to solve domain specific engineering problems
2. Graduates will have the ability to design and conduct experiments, also have the ability to analyze and interpret experimental results.
3. Graduates will have the ability to design systems, processes to meet specified objectives within realistic constraints such as economic, environmental, social, ethical, health, safety and sustainability
4. Graduates will have the ability to conduct investigations to solve the complex problem based on the realistic situation
5. Graduates will have the ability to explore and apply the techniques, skills and modern engineering tools necessary to solve Chemical Engineering problems
6. Graduates will have the knowledge about Engineer’s responsibility for the upliftment of the society.
7. Graduates will have an idea about the impact of process on the environment and resource management.
8. Graduates will have the ability to work as a member of multidisciplinary teams and have an understanding of team leadership
9. Graduates will have the knowledge of professional and ethical responsibilities.
10. Graduates will have the communication skills in English language in verbal and written and also graphical form to convey their innovative ideas in an effective way at various forums.
11. Graduates will have competency in choosing and applying appropriate resource management techniques so as to optimally utilize the available resources
12. Graduate will develop confidence for self education and ability for life-long learning.

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*Attended*

*Director*

*Centre For Academic Courses*

*Anna University, Chennai-600 025*
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%
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

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

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


PH7151  ENGINEERING PHYSICS  L T P C
(Customary to all branches of B.E / B.Tech programmes)  3 0 0 3

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
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:

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<tr>
<th>COURSE OBJECTIVES</th>
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<tbody>
<tr>
<td>- To develop an understanding about fundamentals of polymer chemistry.</td>
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<tr>
<td>- Brief elucidation on surface chemistry and catalysis.</td>
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<tr>
<td>- To develop sound knowledge photochemistry and spectroscopy.</td>
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<tr>
<td>- To impart basic knowledge on chemical thermodynamics.</td>
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<td>- To understand the basic concepts of nano chemistry.</td>
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<tr>
<th>UNIT I POLYMER CHEMISTRY</th>
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<tbody>
<tr>
<td>Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermostatic. 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.</td>
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<th>UNIT II SURFACE CHEMISTRY AND CATALYSIS</th>
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<th>UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY</th>
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<tr>
<th>UNIT IV CHEMICAL THERMODYNAMICS</th>
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<tr>
<td>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.</td>
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<th>UNIT V NANO CHEMISTRY</th>
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<th>TOTAL : 45 PERIODS</th>
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<tr>
<td>COURSE OUTCOMES</td>
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<tr>
<td>- Will be familiar with polymer chemistry, surface chemistry and catalysis.</td>
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<tr>
<td>- Will know the photochemistry, spectroscopy and chemical thermodynamics.</td>
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<tr>
<td>- Will know the fundamentals of nano chemistry.</td>
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TEXT BOOKS

REFERENCE BOOKS

GE7151 COMPUTING TECHNIQUES (Common to all branches of Engineering and Technology)

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
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

UNIT III ARRAYS AND STRINGS

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

UNIT V FUNCTIONS AND USER DEFINED DATA TYPES

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:

GE7152          ENGINEERING GRAPHICS   L   T   P   C
                             3   2   0   4

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

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)  1
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I          PLANE CURVES AND FREE HANDSKETCHING  14
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  14
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  14
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  14
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  15
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)  3
Introduction to drafting packages and demonstration of their use.
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.

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

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-Phenantherolne/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

TEXTBOOKS

GE7161 COMPUTER PRACTICES LABORATORY

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
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
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
Listening: Listening to a panel discussion; Speaking – Speaking at formal situations; Reading –Reading journal articles - Speed reading; Writing-data commentary-describing visual material-writing problem-process- solution-the structure of problem-solution texts-writing critiques

UNIT IV WRITING/ E-MAILING THE JOB APPLICATION
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
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:

MA7251 MATHEMATICS – II
L T P C
4 0 0 4
(Common to all branches of B.E./B.Tech. Programmes in II Semester)

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

UNIT IV COMPLEX INTEGRATION

UNIT V LAPLACE TRANSFORMS

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
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
9

UNIT II  ELECTRICAL AND SUPERCONDUCTING MATERIALS
9

UNIT III  SEMICONDUCTING MATERIALS
9

UNIT IV  DIELECTRIC AND MAGNETIC MATERIALS
9

UNIT V  NEW MATERIALS AND APPLICATIONS
9

TOTAL: 45 PERIODS

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:

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<tr>
<th>CY7255</th>
<th>CHEMISTRY FOR TECHNOLOGISTS</th>
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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.

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

UNIT II OILS, FATS, SOAPS & LUBRICANTS
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

UNIT IV DYE CHEMISTRY
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

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

GE7153  ENGINEERING MECHANICS  L T P C
4 0 0 4

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
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles.

L – 45 + T – 15 TOTAL: 60 PERIODS

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

TEXT BOOK

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, Kirchhoff’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)

TOTAL: 45 PERIODS
OUTCOMES:
Ability to
- Understand electric circuits and working principles of electrical machines
- Understand the concepts of various electronic devices
- Choose appropriate instruments for electrical measurement for a specific application

REFERENCES

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 15

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 15

- 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 15

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.

DEMONSTRATION ON FOUNDRY OPERATIONS.

4. ELECTRONIC ENGINEERING PRACTICES
• 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.

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.

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

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.

TOTAL: 60 PERIODS

REFERENCE BOOKS
1. Environmental pollution analysis, S.M.Khopkar, New age international. 2011
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 - $2^k$ - factorial design - Taguchi’s robust parameter design.

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

TOTAL : 60 PERIODS

TEXT BOOKS:

REFERENCES:

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

UNIT II  CORROSION & ITS CONTROL
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
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

UNIT V  THE DISTRIBUTION LAW & COLLAGIATIVE PROPERTIES
Distribution Co-efficient - Distribution Law - Conditions for the validity of the Distribution law - I$_2$-CCl$_4$-H$_2$O System - Nature of interaction of the solute with one of the solvents - Dissociation - Association - applications of Distribution law - Process of Extraction - Colligative properties - Vapour Pressure Lowering - Osmosis and Osmotic Pressure - The boiling Point elevation - The freezing point depression.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

OBJECTIVE

- To know the principle and importance of various analytical instruments used for the characterization of various materials

UNIT I  INTRODUCTION TO SPECTROSCOPICAL METHODS OF ANALYSIS
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, 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
UNIT II  QUALITATIVE ANALYSIS BY UV AND VISIBLE SPECTROCOPY  9
Lamda max and epsilon max rules, Woodward -Fieser rules for the calculation of absorption maxima (Lamda max) for dienes and carbonyl compounds. Effects of auxochromes and effects of conjugation on the absorption maxima, Different shifts of absorption peaks (Bathochromic, hypsochromic, hypochromic). Instrumentation for UV and Visible spectrophotometers (source, optical parts and detectors), Applications of UV and Visible spectroscopy.

UNIT III  QUANTITATIVE ANALYSIS BY UV AND VISIBLE SPECTROCOPY  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, fingerprint 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  CHROMATOGRAPHIC METHODS  9
Classification of chromatographic methods, column, thin layer, paper, gas, High Performance Liquid Chromatographical methods (principle, mode of separation and technique).

TOTAL: 45 PERIODS

OUTCOME
• 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.

TEXTBOOKS

REFERENCES

CH7351  SOLID MECHANICS FOR TECHNOLOGISTS  L T P C 3 0 0 3

AIM
To give them knowledge on structural, Mechanical properties of Beams, columns.

OBJECTIVES
• The students will be able to design the support column, beams, pipelines, storage tanks and reaction columns and tanks after undergoing this course. This is precursor for the study on process equipment design and drawing.
OUTCOMES:

- Solve the problems related to the structural components under various loading conditions

UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS  

UNIT II  TRANSVERSE LOADING ON BEAMS  

UNIT III  DEFLECTIONS OF BEAMS  
Double integration method – Macaulay’s method – Area – moment theorems for computation of slopes and deflections in beams.

UNIT IV  STRESSES IN BEAMS  

UNIT V  TORSION AND COLUMNS  

TOTAL : 45 PERIODS

TEXT BOOKS


REFERENCE


ME7251  BASIC MECHANICAL ENGINEERING  
L T P C  
3 0 0 3

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

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

CH7301  PRINCIPLES OF CHEMICAL ENGINEERING  L  T  P  C
3  0  0  3

OBJECTIVES
To understand the overall view of the chemical engineering subjects

OUTCOMES
- On completion of the course, students will attain knowledge in fluid behavior and solid properties.
- Understand the concept of chemical engineering principles

UNIT I
Chemistry, Chemical Engineering and Chemical Technology; Chemical process industries:
History and their role in Society; Role of Chemical Engineer; History and Personalities of Chemical Engineering; Greatest achievements of Chemical Engineering.

UNIT II
Components of Chemical Engineering: Role of Mathematics, Physics, Chemistry and Biology; Thermodynamics, Transport Phenomena, Chemical Kinetics and Process dynamics, design and control.

UNIT III
Concept of Unit Processes and Unit Operations; Description of different Unit Processes and Unit Operations; Designing of equipments; Flowsheet representation of process plants, Evolution of an Industry – Sulphuric acid and Soda ash manufacture. Demonstration of simple chemical engineering experiments; Plant visit to a chemical industry

UNIT IV
Role of Computer in Chemical Engineering; Chemical Engineering Software; Visit to Process Simulation Lab; Relation between Chemical Engineering and other engineering disciplines; Traditional vs. modern Chemical Engineering; Versatility of Chemical Engineering: Role of Chemical Engineers in the area of Food, Medical, Energy, Environmental, Biochemical, Electronics etc. Plant visit to an allied industry.

UNIT V
Paradigm shifts in Chemical Engineering; Range of scales in Chemical Engineering; Opportunities for Chemical Engineers; Future of Chemical Engineering.

TOTAL : 45 PERIODS

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EE7361 ELECTRICAL ENGINEERING LABORATORY

OBJECTIVES:
To provide hands on experience on testing and characterization of DC and AC machines.

List of Experiments
1. Study of DC & AC motor starters
2. Open Circuit and Short Circuit test on single phase transformer to draw its equivalent circuit
3. Regulation of three phase alternator
4. Study of three phase circuits
5. Speed Control of DC shunt motor

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
6. Load Test on DC shunt motor
7. OCC & Load Characteristics of DC shunt generator
8. Load test on single-phase transformer
9. Load test on three-phase Induction motor
10. Load test on single-Phase Induction motor

**TOTAL: 60 PERIODS**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Equipment</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>1.</td>
<td>DC Shunt Motor with Loading Arrangement</td>
<td>3HP, 220V, 14A, 750RPM, 0.6A (Shunt field)</td>
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<td>2.</td>
<td>DC Shunt Motor Coupled With Three phase Alternator</td>
<td>DC Shunt Motor kW: 5.2 volts: 220 Amps: 27.5 Speed: 1500 RPM Field</td>
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<td>3.</td>
<td>Single Phase Transformer : 2kVA, 230/110-166 V</td>
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<td>4.</td>
<td>Three Phase Induction Motor with Loading Arrangement</td>
<td>3.7KW, 415v, 7.5A, 1430 RPM</td>
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<td>5.</td>
<td>Single Phase Induction Motor with Loading Arrangement</td>
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<tr>
<td>6.</td>
<td>230V, 5HP, 17A</td>
<td>DC Shunt Motor kW: 7.4 volts: 220 Amps: 38.5 Speed: 960</td>
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<td>7.</td>
<td>6. DC Shunt Motor Coupled With DC Compound</td>
<td>DC Compound Generator kW: 7.5 volts: 220 Amps: 38.5 Speed: 960</td>
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<td>8.</td>
<td>Tachometer -Digital/Analog</td>
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<td>9.</td>
<td>Single Phase Auto Transformer;(0-270)V</td>
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<td>10.</td>
<td>Three Phase Auto Transformer;(0-270)V</td>
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<td>11.</td>
<td>MC Voltmeter-(0-300/600)V</td>
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<td>MC Ammeter (0-10/20)A</td>
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<td>13.</td>
<td>MC Ammeter (0-2/1)A</td>
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<tr>
<td>14.</td>
<td>MI Voltmeter (0-300/600)V</td>
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<td>15.</td>
<td>MI Ammeter (0-10/20)A</td>
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<td>16.</td>
<td>MI Ammeter (0-1/2)A</td>
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<td>17.</td>
<td>UPF Wattmeter (300/600V, 10/20A)</td>
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<td>18.</td>
<td>LPF Wattmeter (300/600V, 10/20A)</td>
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<tr>
<td>19.</td>
<td>Single Phase Resistive Loading Bank(10kW)</td>
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<tr>
<td>20.</td>
<td>Three Phase Resistive Loading Bank(10kW)</td>
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<td>21.</td>
<td>SPST switch</td>
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<td>22.</td>
<td>Fuse various ranges</td>
<td>As per the requirement</td>
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<td>23.</td>
<td>Wires</td>
<td>As per the requirement</td>
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</table>

**Rheostats(100Ω, 1A; 250Ω, 1.5A; 75Ω, 16A, 1000Ω, 1A)**

**OUTCOMES:**
- Ability to conduct experiments on AC and DC machines
- Ability to obtain and analyse the performance characteristics DC and AC machines
ME7262  MECHANICAL ENGINEERING LABORATORY  L T P C  0 0 4 2

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

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.

MA7354  NUMERICAL METHODS  (Branch specific course)  L T P C  4 0 0 4

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  12

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

TEXT BOOKS:

REFERENCES:

CY7256 ORGANIC CHEMISTRY  L T P C
(Common for Petroleum Engineering and Technology and Chemical Engineering)  3 0 0 3

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

OUTCOME
- To gain basic principles involved in different chemical syntheses and apply them in chemical and petrochemical industries.
- 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  9
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  9
Preparation, physical & chemical properties and uses of pyrrole, furan, furfural,
tetrahydrofuran, thiophene, indole, pyridine, quinoline and isoquinoline.

UNIT III  PREPARATION OF SYNTHETIC INTERMEDIATES  9
Preparations of benzenil from benzaldehydes - furil from furfural, vanillin from catechol,
gramine from indole, N-acetyl-5- bromoindoline from indole, salol from phenol, alanine from
propionic acid, heteroauxin from indole - uses, preparation of chloramphenicol – uses.
Reaction and mechanism of acyloin synthesis, Gabriel synthesis, Baeyer –Villigar reaction
and Bartoli- Indole synthesis.

UNIT IV  SYNTHETIC ORGANIC CHEMISTRY  9
Preparation and synthetic utilities of Grignard reagents, ethyl aceto acetate and malonic
ester.

UNIT V  PHARMACEUTICAL CHEMISTRY  9
Synthesis of malonylurea,phenacetin, isoniazid, p-amino benzoic acid (PABA), tryptophan
isopentaquine, chloroquine, sulphanilamide and sulphapyridine.

TOTAL: 45 PERIODS

TEXT BOOKS
USA.

REFERENCES

CH7401  FLUID MECHANICS FOR CHEMICAL ENGINEERS  L T P C
3 0 0 3

OBJECTIVES
To acquire a sound knowledge on fluid properties, fluid statics, dynamic characteristics
of fluid flow for through pipes and porous medium, flow measurement and fluid
machineries

UNIT I  6
Methods of analysis and description - fluid as a continuum – Velocity and stress field -
Newtonian and non-Newtonian fluids – Classification of fluid motion

UNIT II  9
Fluid statics – basic equation - equilibrium of fluid element – pressure variation in a
static fluid - application to manometer – Differential analysis of fluid motion – continuity,
equation of motions, Bernoulli equation and Navier- Stokes equation.

UNIT III  9
The principle of dimensional homogeneity – dimensional analysis, Rayleigh method and
the Pi-theorem - non-dimensional action of the basic equations - similitude - relationship
between dimensional analysis and similitude - use of dimensional analysis for scale up
studies

UNIT IV  12
Reynolds number regimes, internal flow - flow through pipes – pressure drop under
laminar and turbulent flow conditions – major and minor losses; Line sizing; External
flows - boundary layer concepts, boundary layer thickness under laminar and turbulent
flow conditions- Flow over a sphere – friction and pressure drag - flow through fixed and
fluidized beds.
UNIT V
Flow measurement - Constant and variable head meters; Velocity measurement techniques; Types, characteristics and sizing of valves; Classification, performance characteristics and sizing of pumps, compressors and fans.

TOTAL : 45 PERIODS

OUTCOMES
- Understand the fundamental properties of fluids and its characteristics under static conditions.
- Develop empirical correlation using dimensionless analysis.
- Analyze flow of fluid through pipe and over the of solid.
- Understand and select flow meter(s), characteristics of pumps used in Chemical Process Industries.

TEXT BOOKS

REFERENCES

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CH7403 MECHANICAL OPERATIONS

OBJECTIVES
The students will learn characterization of solids, size reduction, techniques of solid - fluid separation and mixing.

UNIT I
General characteristics of solids, different techniques of size analysis, shape factor, surface area determination, estimation of particle size. Screening methods and equipment, screen efficiency, ideal and actual screens.

UNIT II
Laws of size reduction, energy relationships in size reduction, methods of size reduction, classification of equipments, crushers, grinders, disintegrators for coarse, intermediate and fine grinding, power requirement, work index; size enlargement - principle of granulation, briquetting, pelletisation, and flocculation.

UNIT III
Gravity settling, sedimentation, thickening, elutriation, double cone classifier, rake classifier, bowl classifier. Centrifugal separation - continuous centrifuges, super centrifuges, design of basket centrifuges; industrial dust removing equipment, cyclones and hydro cyclones, electrostatic and magnetic separators, heavy media separations, floatation, jigging.

UNIT IV
Theory of filtration, Batch and continuous filters, Flow through filter cake and filter media.
compressible and incompressible filter cakes, filtration equipments - selection, operation and design of filters and optimum cycle of operation, filter aids.

UNIT V
Mixing and agitation - Mixing of liquids (with or without solids), mixing of powders, selection of suitable mixers, power requirement for mixing. Storage and Conveying of solids - Bunkers, silos, bins and hoppers, transportation of solids in bulk, conveyer selection, different types of conveyers and their performance characteristics.

TOTAL : 45 PERIODS

OUTCOMES
- Apply the principles of size analysis and size reduction techniques of solids by selecting proper equipments such as crushers, grinders, etc.,
- Understand the working principles of thickeners, gravity settling tanks, cyclone separators, Filters and other mechanical separation devices
- Select mixing and agitation equipments, storage and transportation equipments used for handling solids in Chemical process industries.

TEXT BOOKS

REFERENCES

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CH7402 HEAT TRANSFER FOR CHEMICAL ENGINEERS

OBJECTIVES
To learn heat transfer by conduction, convection and radiation and heat transfer equipments like evaporator and heat exchanger.

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

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

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

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

OUTCOMES
Understand the fundamentals of heat transfer mechanism Evaluate film coefficients. Understand the applications of heat transfer equipments and determine the efficiency and effectiveness of evaporators and heat exchangers.

TEXT BOOKS

REFERENCES

Course outcomes | Programme Outcomes
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D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12
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Energy balances with chemical reaction, Efficiency applications.

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

TOTAL : 45 PERIODS

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

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CH7411 FLUID MECHANICS LABORATORY

OBJECTIVES
To learn experimentally to calibrate flow meters, find pressure loss for fluid flows and determine pump characteristics.

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

EQUIPMENT REQUIRED
1. Viscometer
2. Venturi meter
3. Orifice meter
4. Rotameter
5. Weir
6. Open drum with orifice
7. Pipes and fittings
8. Helical and spiral coils
OUTCOMES
- Use variable area flow meters and variable head flow meters
- Analyze the flow of fluids through closed conduits, open channels and flow past immersed bodies
- Select pumps for the transportation of fluids based on process conditions/requirements and fluid properties

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TOTAL : 60 PERIODS

CY7411 ORGANIC CHEMISTRY LAB LT P C 0 0 4 2

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

LIST OF EXPERIMENTS
1. Quantitative analysis of organic compounds – Identification of aliphatic/aromatic, saturated/unsaturated compounds.
2. Identification and characterization of various functional groups by their characteristic reactions: a) alcohol, b) aldehyde, c) ketone, d) carboxylic acid, e) phenol, f) ester, g) primary, secondary and tertiary amines h) imide i) nitro compounds.
5. Analysis of proteins.
6. Methodology of filtration and recrystallization.
7. Introduction to organic synthetic procedures:
   i. Acetylation – Preparation of acetanilide from aniline.
   ii. Hydrolysis – Preparation of salicylic acid from methyl salicylate, iii.
   Substitution – Conversion of acetone to iodoform.
   iv. Nitration – Preparation of m-dinitrobenzene from nitrobenzene.
   v. Oxidation – Preparation of benzoic acid from benzaldehyde/ benzyl alcohol

OUTCOME:
Conduct simple experiments to identify the nature (aliphatic/aromatic), (Saturated/Unsaturated) of organic compounds. Conduct simple experiments to identify the functional groups. Prepare organic compounds like acetanilide, salicylate, m-dinitrobenzene etc.,

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

UNIT II  
Design of continuous reactors - stirred tank and tubular flow reactor, recycle reactors, combination of reactors, size comparison of reactors.

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

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

UNIT V  
The residence time distribution as a factor of performance; residence time functions and relationship between them in reactor; basic models for non-ideal flow; conversion in non-ideal reactors

TOTAL : 45 PERIODS

OUTCOMES
- Apply the principles of reaction kinetics, formulate rate equations and analyse the batch reactor data.
- Analyze the experimental kinetic data to select a suitable reactor for a particular application and to workout conversion and space time for different types of reactors. Evaluate selectivity, reactivity and yield for parallel and mixed reactions.
- Examine how far real reactors deviate from the ideal.

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CH7504  
MASS TRANSFER I

OBJECTIVES
Students will learn to determine mass transfer rates under laminar and turbulent conditions and apply these concepts in the design of humidification columns, dryers and crystallisers.

UNIT I  
Introduction to mass transfer operations; Molecular diffusion in gases, liquids and solids; diffusivity measurement and prediction; multi-component diffusion.
UNIT II  
Eddy diffusion, concept of mass transfer coefficients, theories of mass transfer, different transport analogies, application of correlations for mass transfer coefficients, inter phase mass transfer, relationship between individual and overall mass transfer coefficients. NTU and NTP concepts, Stage-wise and differential contractors.

UNIT III  
Humidification – Equilibrium, humidity chart, adiabatic and wet bulb temperatures; humidification operations; theory and design of cooling towers, dehumidifiers and humidifiers using enthalpy transfer unit concept.

UNIT IV  
Drying– Equilibrium; classification of dryers; batch drying – Mechanism and time of cross through circulation drying, continuous dryers – material and energy balance; determination of length of rotary dryer using rate concept.

UNIT V  
Crystallization - Equilibrium, classification of crystallizers, mass and energy balance; kinetics of crystallization – nucleation and growth; design of batch crystallizers; population balance model and design of continuous crystallizers.

TOTAL : 45 PERIODS

OUTCOMES
- Understand diffusion operations and theories of mass transfer
- Understand the concept of inter-phase mass transfer and gas- liquid mass transfer operations like humidification
- Apply the knowledge gained in mass transfer to perform simple calculations in drying and crystallization

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CH7501 CHEMICAL ENGINEERING THERMODYNAMICS- I L T P C 3 0 0 3

OBJECTIVES
Students will learn PVT behaviour of fluids, laws of thermodynamics, thermodynamic property relations and their application to fluid flow, power generation and refrigeration processes.
UNIT I
Scope of thermodynamics; Definition of system, control volume, state and path function, equilibrium, reversibility, energy, work and heat; zeroth law; temperature scales

UNIT II
PVT behaviour of fluids; Mathematical representation of PVT behaviour; Generalized compressibility factor correlation; Generalized equations of state

UNIT III
Joule’s experiment, internal energy, first law, energy balance for closed systems, mass and energy balance for open systems Statements of the second law of thermodynamics, heat engine and refrigerator, Carnot cycle and Carnot theorems, thermodynamic temperature scale, entropy and its calculation, second law of thermodynamics for a control volume, Third law of thermodynamics, entropy from a microscopic point of view.

UNIT IV
Thermodynamic potentials – internal energy, enthalpy, Helmholtz free energy, Gibbs free energy; thermodynamic property relations – Maxwell relations – partial derivatives and Jacobian method; residual properties; thermodynamic property tables and diagrams

UNIT V
Duct flow of compressible fluids, Compression and expansion processes, steam power plant, internal combustion engines, jet and rocket engines.

TOTAL : 45 PERIODS

OUTCOMES
- Understand the fundamental concepts of thermodynamics
- Apply second law and analyze the feasibility of systems/devices; understand the real gas behaviour
- Understand thermodynamic formulations and the working of compressors and expanders

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CH7503 CHEMICAL TECHNOLOGY L T P C 3 0 0 3

OBJECTIVE
To gain knowledge on unit processes and unit operations involved in the manufacture of different chemicals in different industries like chloro-alkali, petroleum, pharmaceutical, fertilizer etc.
UNIT I
Introduction to chemical processing; symbolic representation of different unit operations and unit processes to build a flow sheet

UNIT II
Chlor-Alkali Industries, Cement, Glass and ceramics, Pulp and paper.

UNIT III
Oil, Soap and Detergent, Petroleum Refining, Petrochemicals, Polymers

UNIT IV
Pharmaceuticals, Chemical Explosives, Paints and Pigments.

UNIT V
Dyes and intermediates, Fertilizers, Sugar, Food Products

OUTCOMES
- Understand the role of Chemical Engineers in process industries such as pulp and paper etc., and manufacture of cement, Glass and cements.
- Understand manufacturing processes of oil, soap, detergent, petrochemicals, polymers, pharmaceuticals, paints, dyes and intermediates, fertilizer, sugar, food products etc.
- Understand the unit processes involved in petroleum refining etc.

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CH7561 HEAT TRANSFER LABORATORY

COURSE OBJECTIVES
Students develop a sound working knowledge on different types of heat transfer equipments

COURSE 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

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

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CH7511 MECHANICAL OPERATIONS LABORATORY L T P C 0 0 4 2

OBJECTIVES
Students develop a sound working knowledge on different types of crushing equipments and separation characteristics of different mechanical operation separators.

LIST OF EXPERIMENTS*
1. sieve analysis
2. Batch filtration studies using a Leaf filter
3. Batch filtration studies using a Plate and Frame Filter press
4. Characteristics of batch Sedimentation
5. Reduction ratio in Jaw Crusher
6. Reduction ratio in Ball mill
7. Separation characteristics of Cyclone separator
8. Reduction ratio of Roll Crusher
9. Separation characteristics of Elutriator
10. Reduction ratio of Drop weight crusher
11. Size separation using Sub-Sieving

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.
*Minimum 10 experiments shall be offered

TOTAL : 60 PERIODS

46
OUTCOMES
- 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.

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CH7602 CHEMICAL REACTION ENGINEERING – II

OBJECTIVES
The objective is to study the non-ideal behavior of homogeneous reactors, gas-solid catalytic and non-catalytic reactors and gas-liquid reactors.

UNIT I
Nature of catalysts, surface area and pore-volume distribution, catalyst preparation.

UNIT II
Rate equations for heterogeneous reactions, adsorption isotherms, rates of adsorption and desorption, surface reaction analysis of rate equation and rate controlling steps,

UNIT III
Diffusion within catalyst particle, effective thermal conductivity, mass and heat transfer within catalyst pellets, effectiveness factor, Thiele Modulus, fixed bed reactors.

UNIT IV
Models for explaining kinetics; volume and surface models; controlling resistances and rate controlling steps; time for complete conversion for single and mixed sizes, fluidized and static reactors.

UNIT V
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 : 45 PERIODS

OUTCOMES
- Understand catalysis and preparation and characterization, Apply adsorption isotherms for analysis of development of rate equations and rate controlling steps.
- Understand the mechanism of pore diffusion in catalyst to calculate effectiveness factors and to demonstrate the application of volume and surface models and to calculate conversion in non ideal flow reactor.
- Design the absorption column combined with chemical reactions.

TEXT BOOKS

REFERENCES
**Course outcomes** | **Programme Outcomes**
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**CH7603**  
**MASS TRANSFER II**  
**L T P C**  
3 0 0 3

**OBJECTIVES**
Students will learn to design absorber and stripper, distillation column, extraction and leaching equipments and adsorber.

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

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

**UNIT III  LIQUID-LIQUID EXTRACTION**  
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. Pulsed extractors, centrifugal extractors-Supercritical extraction

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

**UNIT V  ADSORPTION AND ION EXCHANGE**  
Adsorption - Types of adsorption, nature of adsorbents, adsorption equilibria, effect of pressure and temperature on adsorption isotherms, Adsorption operations - stage wise operations, steady state moving bed and unsteady state fixed bed adsorbers, break through curves. Principle of Ion exchange, techniques and applications.

**TOTAL : 45 PERIODS**

**OUTCOMES**
- Understand absorption and distillation operations and select methods of separation of mixtures based on mass transfer concepts.
- Apply the ternary equilibrium diagram concepts to determine the number of stages required for separation of liquid-liquid and solid-liquid mixtures Design a distillation tower and to perform calculations in adsorption operation

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CH7601 CHEMICAL ENGINEERING THERMODYNAMICS II

OBJECTIVES
The Students will be well versed with the behavior of fluids under PVT conditions and also apply them for practical purpose. Main advantage will be to deal with power production and refrigeration processes. The study further provides a comprehensive exposition to theory and application of solution thermodynamics.

UNIT I PROPERTIES OF SOLUTIONS
Partial molar properties, ideal and non-ideal solutions, standard states definition and choice, Gibbs-Duhem equation, excess properties of mixtures.

UNIT II PHASE EQUILIBRIA
Criteria for equilibrium between phases in multi component non-reacting systems in terms of chemical potential and fugacity, application of phase rule, vapour-liquid equilibrium, phase diagrams for homogeneous systems and for systems with a miscibility gap, effect of temperature and pressure on azeotrope composition, liquid-liquid equilibrium, ternary liquid-liquid equilibrium.

UNIT III CORRELATION AND PREDICTION OF PHASE EQUILIBRIA
Activity coefficient-composition models, thermodynamic consistency of phase equilibria, application of the correlation and prediction of phase equilibria in systems of engineering interest particularly to distillation and liquid extraction processes.

UNIT IV CHEMICAL REACTION EQUILIBRIA
Definition of standard state, standard free energy change and reaction equilibrium constant, evaluation of reaction equilibrium constant, prediction of free energy data, equilibria in chemical reactors, calculation of equilibrium compositions for homogeneous chemical reactors, thermodynamic analysis of simultaneous reactions.

UNIT V REFRIGERATION

TOTAL: 45 PERIODS

OUTCOMES
- Understand and evaluate the thermodynamic properties of pure fluids and solutions Evaluate and analyze the phase equilibrium data
- Analyze chemical reaction rates and evaluate the performance of refrigeration cycles

TEXT BOOKS
2. Narayanan K.V “A Text Book of Chemical Engineering Thermodynamics” Prentice
Hall of India Pvt. Ltd. 2001.

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CH7651 PROCESS INSTRUMENTATION, DYNAMICS AND CONTROL

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
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
Laplace transformation, application to solve ODEs. Open-loop systems, first ordersystems 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
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
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
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

OUTCOMES
- Understand the prerequisites of control strategies and design different process control systems Evaluate the suitable controllers for different chemical process.
- Analyse and tune the control systems unto stability Understand the mechanism of advance control systems

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CH7661 CHEMICAL REACTION ENGINEERING LABORATORY

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.

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

LIST OF EXPERIMENTS
1. Separation of binary mixture using Simple distillation
2. Separation of binary mixture using Steam distillation
3. Separation of binary mixture using Packed column distillation
4. Measurement of diffusivity
5. Liquid-liquid extraction
6. Drying characteristics of forced draft dryer
7. Adsorption studies
8. Cross current leaching studies
9. Surface evaporation
10. Wetted wall column
11. Solid Liquid mass transfer studies
12. Water purification using ion exchange columns
13. Mass transfer characteristics of Rotating disc contactor
14. Estimation of mass/heat transfer coefficient for cooling tower
15. Demonstration of Gas – Liquid absorption

EQUIPMENTS REQUIRED
1. Simple distillation setup
2. Steam distillation setup
3. Packed column
4. Liquid-liquid extractor
5. Forced draft dryer
6. Wetted wall column
7. Ion exchange column
8. Rotating disc contactor
9. Cooling tower
10. Absorption column

*Minimum 10 experiments shall be offered.

TOTAL : 60 PERIODS

OUTCOMES
- Determine diffusivity, mass transfer rate and mass transfer co-efficient of given system using fundamental principles.
- Evaluate the performance/calculate the parameters in different distillation processes.
- Evaluate the performance/calculate the parameters in Leaching extraction and drying operations.

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CH7702
PROCESS EQUIPMENT DESIGN

OBJECTIVES
Students learn to do in detail process and mechanical design and engineering drawing of different chemical engineering equipments
UNIT I 12
Heat Exchangers, Condensers, Evaporators

UNIT II 12
Cooling Tower, Dryers

UNIT III 12
Absorption column, Distillation Column, Extraction Column, Adsorption column

UNIT IV 12
Packed bed Reactors, Pressure Vessel, Storage Vessel

UNIT V 12
Design of Plant Layout, Pipe Lines and Pipe Layouts, Schematics and Presentation Materials of Construction and Selection of process equipments

TOTAL : 60 PERIODS

OUTCOMES
- Apply the skill in thermal design of heat transfer equipment like shell and tube, double pipe heat exchangers and evaporators, and assessing thermal efficiency of the above equipment in practice.
- Demonstrate the skills in basic design and drawing of different dryers, cooling towers and cyclone separators.
- Apply the concepts involved in phase separation and design of distillation, Extraction and absorption columns.
- Demonstrate the skills in mechanical design of process equipment, design considerations of pressure vessels and its auxiliary devices design the layout of process industries

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CH7751  TRANSPORT PHENOMENA  LTPC  3 0 0 3

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

UNIT I 9
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   EQUATIONS OF CHANGE AND TURBULENT FLOW  9
Equation of continuity, motion, mechanical energy, use of equations of change to solve flow problems, dimensional analysis of equations of change, comparison of laminar and turbulent flows, time-smoothed equation of change, empirical expressions.

UNIT III  ENERGY TRANSPORT  9
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 IV  EQUATIONS OF CHANGE FOR NON ISOTHERMAL SYSTEM AND TEMPERATURE DISTRIBUTION IN TURBULENT FLOWS  9
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 V  MASS TRANSPORT, EQUATIONS OF CHANGE FOR MULTICOMPONENT SYSTEMS AND CONCENTRATION DISTRIBUTION IN TURBULENT FLOWS  9
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 laminar flow : stagnant gas film, heterogeneous and homogeneous chemical reaction systems, falling film, porous catalyst. The equation of continuity, summary of equations of change and fluxes, use of equations of change, dimensional analysis, time smoothed equations of change, empirical expressions for turbulent mass flux.

TOTAL : 45 PERIODS

OUTCOMES
- Understand the principles of momentum, heat and mass transport by developing mathematical models to determine respective fluxes and velocity, temperature and concentration distribution for flow channels, heat sources and systems involving diffusion and reactions.
- Apply the equation of change and scale factors for different coordinate systems and solve of momentum, mass and heat transport problems.
- Analyze the analogy between the transports and understand the turbulence and boundary layer concept in heat and mass transport.

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OBJECTIVES
To enable the students to understand the various concepts of economics, process development, design consideration and cost estimation in chemical industry.

UNIT I INTEREST AND PLANT COST
9
Time value of money - equivalence, Depreciation, Depletion, estimation of capital cost, Capital requirement for complete plant, cost indices, capital recovery.

UNIT II PROJECT PROFITABILITY AND FINANCIAL RATIOS
9

UNIT III ECONOMIC BALANCE IN EQUIPMENTS
9
Essentials of economic balance, economic balance in batch operations, cyclic operations, economic balance for insulation, evaporation, heat transfer equipments.

UNIT IV PRINCIPLES OF MANAGEMENT
9
Principles of management, planning, organizing, staffing, coordinating, directing, controlling and communicating. Types of organizations, Management information systems (MIS).

UNIT V PRODUCTION PLANNING CONTROL
9
Work measurement techniques, motion study, principles of time study, elements of production control, forecasting, planning, routing, scheduling, dispatching, inventory and control, role of control charts in production and quality control.

TOTAL : 45 PERIODS

OUTCOMES:
- Students will be able to understand the theory behind Inventory Control, Organization Types and PPC.
- Provides the student with an ability to integrate knowledge about financial statements, Depreciation Accounting and other areas.

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CH7711 COMPUTATIONAL PROGRAMMING CHEMICAL ENGINEERING LABORATORY

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

Programming in C
C programs will be written to solve problems from core courses of chemical
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

OUTCOMES
• 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.

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CH7712 PROCESS CONTROL LABORATORY FOR CHEMICAL ENGINEERS

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

LIST OF EXPERIMENTS
1. Response of first order system
2. Response of second order system
3. Response of Non-Interacting level System
4. Response of Interacting level System
5. Open loop study on a level system
6. Open loop study on a flow system
7. Open loop study on a thermal system
8. Closed loop study on a level system
9. Closed loop study on a flow system
10. Closed loop study on a thermal 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

OUTCOMES
- Understand the prerequisites of control strategies and design different process control systems. Evaluate the suitable controllers for different chemical processes.
- Analyse and tune the control systems unto stability

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CH7713 SEMINAR

OBJECTIVES
The objective of the seminar is to communicate the idea very effectively and efficiently.

OUTCOMES
Students will be able to convey their innovative ideas in an effective way at various forums.

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CH7812 PROJECT WORK

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

OUTCOMES
Design a manufacturing chemical process. Prepare clear concise project reports with the help of graphs, charts, and pictorial representation.

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

Students, in addition to the home problem, will be permitted to undertake industrial/consultancy project work, outside the department, in industries/Research labs for which proportional weightage will be given in the final assessment.

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CH7811  INDUSTRIAL INTERNSHIP  L T P C  0 0 0 2

COURSE OBJECTIVES

The objective of the Industrial Internship is to make use of the knowledge gained by the student at various stages of the degree course in industries to acquire the practical knowledge and experience.

COURSE OUTCOMES

Gain the practical knowledge by applying the theoretical concepts to solve the industrial problems

Students have to undergo four weeks practical training in any Chemical industry of their choice with the approval of the department during summer/winter vacation. At the end of the training, students should submit a report as per the prescribed format to the department. Each student is required to submit a Industrial Internship report. The report should be based on the information and knowledge gained from the industry.

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MA7072  STATISTICS AND LINEAR PROGRAMMING  L T P C  4 0 0 4

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.

TOTAL : 60 PERIODS
• Have the knowledge of applying Linear programming tools in management problems.

TEXT BOOKS:

REFERENCES:

CH7002 DRUGS AND PHARMACEUTICAL TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES
Students will gain fundamental knowledge about Drugs and Pharmaceutical and their manufacturing process

UNIT I INTRODUCTION
Development of drugs and pharmaceutical industry; organic therapeutic agents uses and economics

UNIT II DRUG METABOLISM AND PHARMACO KINETICS & MICROBIOLOGICAL AND ANIMAL PRODUCTS
Drug metabolism; physico chemical principles; pharma kinetics-action of drugs on human bodies. Antibiotics- gram positive, gram negative and broad spectrum antibiotics; hormones

UNIT III IMPORTANT UNIT PROCESSES AND THEIR APPLICATIONS
Chemical conversion processes; alkylation; carboxylation; and condensation cyclisation, dehydration, esterification, halogenation, oxidation, sulfonation; complex, chemical conversions fermentation.

UNIT IV MANUFACTURING PRINCIPLES & PACKING AND QUALITY CONTROL
Compressed tablets; wet granulation; dry granulation or slugging; advancement in granulation; direct compression, tablet presses formulation; coating pills; capsules sustained action dosage forms; parental solutions, oral liquids; injections; ointments; standard of hygiene and manufacturing practice. Packing; packing techniques; quality control.

UNIT V PHARMACEUTICAL PRODUCTS & PHARMACEUTICAL ANALYSIS
Vitamins; cold remedies; laxatives; analgesics; nonsteroidal contraceptives; external antiseptics; antacids and others. Analytical methods and tests for various drugs and pharmaceuticals – spectroscopy, chromatography, fluorimetry, polarimetry, refractometry, pHmetry

TOTAL : 45 PERIODS

OUTCOMES
• Understand the Drug Metabolism and pharmaco–kinetics principles
• Apply knowledge of unit processes and analytical methods to develop new processes and product formulations.
• Demonstrate statistical quality control procedure and quality assurance programmes in various stages of pharmaceutical process.
TEXT BOOK

REFERENCES

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CH7003 ELECTROCHEMICAL ENGINEERING L T P C
3 0 0 3

OBJECTIVES
Students will gain knowledge about electrochemical process and its application.

UNIT I

UNIT II
Mass transfer in electrochemical systems: diffusion controlled electrochemical reaction –the importance of convention and the concept of limiting current. over potential, primary-secondary current distribution –rotating disc electrode.

UNIT III

UNIT IV

UNIT V
Electrodes used in different electrochemical industries: Metals-Graphite –Lead dioxide – Titanium substrate insoluble electrodes –Iron oxide –semi conducting type etc. Metal finishing-cell design. types of electrochemical reactors, batch cell, fluidized bed electrochemical reactor, filter press cell, Swiss roll cell, plug flow cell, design equation, figures of merits of different type of electrochemical reactors.

TOTAL : 45 PERIODS

OUTCOMES
- The principles of electrochemistry and mechanism involved in electrochemical systems
- Understand the mechanism of corrosion.
- Apply the concepts involved in electro process and design of batteries, fuel cell and electrochemical reactors
TEXT BOOKS

REFERENCES

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CH7071 ENERGY TECHNOLOGY 3 0 0 3

OBJECTIVES
Students will gain knowledge about different energy sources

UNIT I ENERGY 8
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 8
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 10
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 10
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 9
Energy conservation - Act; Energy management importance, duties and responsibilities; Energy audit – Types methodology, reports, instruments. Benchmalcing 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

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CH7004 FRONTIERS OF CHEMICAL ENGINEERING

OBJECTIVES
Students will know the latest trends to be followed in the process industries

UNIT I PROCESS INTENSIFICATION
Novel reactor configurations; combination of reaction and separation; use of different energy fields, lab on a chip.

UNIT II CHEMICAL PRODUCT DESIGN
Scope and importance; identification of needs and specifications; sources of ideas and screening ideas; selection of product idea; process development for product manufacture; specialty chemical manufacture; economic aspects.

UNIT III RENEWABLE ENERGY
Hydrogen production, Hydrogen economy, Fuel Cell Technology, biofuel cells and bio-hydrogen, solar energy

UNIT IV MATERIALS ENGINEERING
Polymers and composites, ceramics and glasses, colloidal dispersions and nanoparticles, thin films and electronic materials

UNIT V BIOENGINEERING
Biomechanics, biotransport and biomaterials, biomolecular and cellular engineering, drug discovery and development.

TOTAL : 45 PERIODS

OUTCOMES
Understand the new process and reactor configuration used in industries Know the new sources of renewable energy and new material & its application

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CH7006  MODERN SEPARATION TECHNIQUES  

OBJECTIVES  
Students will gain knowledge about recent separation methods

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

UNIT II  MEMBRANE SEPARATIONS  
Types and choice of Membranes, Plate and Frame, tubular, spiral wound and hollow fiber Membrane Reactors and their relative merits, commercial, Pilot Plant and Laboratory Membrane permeators involving Dialysis, Reverse Osmosis, Nanofiltration, Ultra filtration and Micro filtration, Ceramic- Hybrid process and Biological Membranes.

UNIT III  SEPARATION BY ADSORPTION  
Types and choice of Adsorbents, Adsorption Techniques, Dehumidification Techniques, Affinity Chromatography and Immuno Chromatography, Recent Trends in Adsorption.

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

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

TOTAL : 45 PERIODS

OUTCOMES  
- Create the understanding of separation processes for selecting optimal process for new and innovative applications. Ability to exhibit the skill to develop membrane processes, adsorption process and inorganic separation process.
- Apply the latest concepts like super critical fluid extraction, pervaporation, lyophilisation etc., in Chemical process industries.
- Understand Innovative techniques of controlling and managing oil spills.

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CH7007  OPTIMIZATION OF CHEMICAL PROCESSES  L T P C  3 0 0 3

OBJECTIVES
Students will gain knowledge about process modeling and optimization

UNIT I  INTRODUCTION  5
Introduction to optimization; applications of optimization in chemical engineering; classification of optimization problems.

UNIT II  SINGLE VARIABLE OPTIMIZATION  9
Necessary and sufficient conditions for optimum; region elimination methods; interpolation methods; direct root methods.

UNIT III  MULTIVARIABLE OPTIMIZATION WITHOUT AND WITH CONSTRAINTS  9
Necessary and sufficient conditions for optimum; direct search methods; indirect search methods.

UNIT IV  OTHER OPTIMIZATION METHODS  9
Introduction to geometric, dynamic and integer programming and genetic algorithms.

UNIT V  APPLICATIONS OF OPTIMIZATION  13
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.

TOTAL : 45 PERIODS

OUTCOMES
- Design experiments and formulate models of chemical processes/equipment.
- Understand different search methods and linear programming methods for solution of chemical process problems like optimization of process variables to get maximum yield/conversion, product mix pattern product distribution etc.,
- Understand the non-linear programming methods for application in R & D work.

TEXT BOOKS
OBJECTIVES
Students will gain knowledge about petroleum refining process and production of petrochemical products

UNIT I

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

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

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

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

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

TEXT BOOKS

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OBJECTIVES
Students will gain knowledge about mechanism of polymer process and its application

UNIT I GENERAL ASPECTS OF POLYMERS 9
Classification, mechanisms and methods of polymerization, Properties-Molecular weight, Glass transition temperature, Crystallinity, thermal, Electrical and Mechanical properties

UNIT II APPLICATION ORIENTED POLYMERS 9
Resins – PVC, Silicon Oil and resins, fibrous Polymers – Nylon 66, Polyacrylonitrile, adhesives-Epoxides, Phenol formaldehyde, Urea formaldehyde

UNIT III ELASTOMERS 9
Natural Rubber, Styrene – butadiene, Polyisopropene – Neoprene, Silicone rubber, Thermoplastic elastomers

UNIT IV PROCESSING OF POLYMERS 9
Processing additives, plasticizers, Antiaging additives, surface and optical properties, modifiers, fire retardants, additives for rubber and elastomers, various molding techniques

UNIT V PHYSICAL AND CHEMICAL TESTING OF PLASTICS 9
Mechanical properties, tensile strength and hardness, electrical properties, volume resistivity, dielectric strength, optical properties-glass, light transmission and refractive index, chemical analysis – elemental and functional analysis

TOTAL : 45 PERIODS

OUTCOMES
- Understand the fundamental of mechanism of polymerization
- Apply the mechanism and effectiveness of polymerization in designing reactor systems. Understand the knowledge of polymer stability for developing new formulations and products
- Acquire knowledge on different test for characterization of polymer for applications in R & D work; understand the manufacture and properties of industrial polymers.

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OBJECTIVES

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

UNIT I  INTRODUCTION

Introduction to modeling and simulation, classification of mathematical models, conservation equations and auxiliary relations.

UNIT II  STEADY STATE LUMPED SYSTEMS

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

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

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


TOTAL : 45 PERIODS

OUTCOMES

- 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


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CH7011 PROCESS PLANT UTILITIES L T P C 3 0 0 3

OBJECTIVES
Students will gain knowledge about auxiliary equipments used in chemical process plants

UNIT I IMPORTANT OF UTILITIES
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 AND STEAM GENERATION
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, Chlorofluor Carbons and Brins. Refrigerating Effects and liquefaction Processes.

UNIT IV COMPRESSED AIR

UNIT V FUEL AND WASTE DISPOSAL

TOTAL : 45 PERIODS

OUTCOMES
- Comprehend the principles of water treatment, and methods of treating cooling water; understand the principles of efficient steam generation and utilisation.
- Understand methods of compression of air, air drying system and different types refrigeration and humidification systems used in process industries; simple calculations of compressors Understand the types of fuels and its disposal methods.

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

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

UNIT II  LOGISTICS MANAGEMENT

UNIT III  SUPPLY CHAIN NETWORK DESIGN

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

UNIT V  COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN
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

TOTAL : 45 PERIODS

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

REFERENCES
2. Logistics, David J.Bloomberg, Stephen Lemay and Joe B.Hanna, PHI 2002
4. Modeling the supply chain, Jeremy F.Shapiro, Thomson Duxbury, 2002
OBJECTIVES
Students will gain fundamental knowledge about biochemical reactions and its application to the reactor design

UNIT I INTRODUCTION
Industrial biochemical processes with typical examples, comparing chemical and biochemical processes, development and scope of biochemical engineering as a discipline. Industrially important microbial strains; their classification; structure; cellular genetics.

UNIT II KINETICS OF ENZYME ACTION
Kinetics of enzyme catalyzed reaction: the enzyme substrate complex and enzyme action, modulation and regulation of enzyme activity, types of inhibition. Immobilized enzyme technology: enzyme immobilization. Immobilized enzyme kinetics: effect of external mass transfer resistance.

UNIT III KINETICS OF MICROBIAL GROWTH
Kinetics of cellular growth in batch and continuous culture, models for cellular growth unstructured, structured and cybernetic models; medium formulation. Thermal death kinetics of cells and spores, stoichiometry of cell growth and product formation; Design and analysis of biological reactors.

UNIT IV TRANSPORT PHENOMENA
Transport phenomena in bioprocess systems: Gas-liquid mass transfer in cellular systems, determination of oxygen transfer rates, power requirements for sparged and agitated vessels, scaling of mass transfer equipment, heat transfer.

UNIT V DOWN STREAM PROCESSING
Downstream processing: Strategies to recover and purify products; separation of insoluble products, filtration and centrifugation; cell disruption-mechanical and non-mechanical methods; separation of soluble products: liquid-liquid extractions, membrane separation (dialysis, ultrafiltration and reverse osmosis), chromatographic separation-gel permeation chromatography, electrophoresis, final steps in purification – crystallization and drying.

TOTAL: 45 PERIODS

OUTCOMES
- Apply the knowledge of micro organisms and enzymes to study different biochemical reactions and rate equations.
- Understand transport mechanisms and sterilization concepts to design and analyze bioreactors.
- Understand the downstream processing and industrial bioreactors

TEXT BOOKS

REFERENCES

71
OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)
Disaster cycle - Phases, Culture of Safety, Prevention, Mitigation And Preparedness Community based DRR, Structural- nonstructural Measures, Roles and responsibilities of-community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes 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
Factors Affecting Vulnerabilities, Differential Impacts, Impact of Development Projects such as Dams, Embankments, and 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

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and Field Works Related to Disaster Management.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, 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:**

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

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

**UNIT I**
9

**UNIT II**
9

**UNIT III**
9
Theories and Perspectives of UN Laws – UN Agencies to Monitor and Compliance.

**UNIT IV**
9
Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V**
9

**OUTCOMES:**
Upon completion of the course, the students will be able to
- Acquire the basic knowledge of human rights.

**REFERENCES:**
Students learn about implementation of safety procedures, risk analysis and assessment, hazard identification.

UNIT I
9
Need for safety in industries; Safety Programmes – components and realization; Potential hazards – extreme operating conditions, toxic chemicals; safe handling.

UNIT II
9
Implementation of safety procedures – periodic inspection and replacement; Accidents – identification and prevention; promotion of industrial safety.

UNIT III
9
Overall 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
9
Hazard identification safety audits, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazan past accident analysis Fijxborough-Mexico-Madras-Vizag-Bopal analysis.

UNIT V
9
Hazop-guide words, parameters, derivation-causes-consequences-recommendation-coarse Hazop study-case studies-pumping system-reactor-mass transfer system.

TOTAL: 45 PERIODS

OUTCOMES
- Demonstrate the awareness of plant safety in selection and layout of chemical plants and the usage of safety codes.
- Exhibit the skill in classifying chemical, fire, explosion hazards and to understand the occupational diseases.
- Analyze the medical and engineering response to health hazards and to implement the effective process control and instrumentation.

TEXT BOOKS

REFERENCES

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<thead>
<tr>
<th>Course outcomes</th>
<th>Programme Outcomes</th>
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<td>CO</td>
<td>1 2 3 4 5 6 7 8 9</td>
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GE7251 ENVIRONMENTAL SCIENCE AND ENGINEERING
OBJECTIVES:
- To study the 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
- 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
- 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


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

- 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:
UNIT I  FUNDAMENTALS OF PRODUCT DEVELOPMENT  9

UNIT II  REQUIREMENTS AND SYSTEM DESIGN  9

UNIT III  DESIGN AND TESTING  9

UNIT IV  SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT  9

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY  9

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: