## SEMESTER I

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OBJECTIVES

- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I  MATRICES  

UNIT II  FUNCTIONS OF SEVERAL VARIABLES  

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 = a + z , az, 1/z, - Bilinear transformation.

UNIT IV  COMPLEX INTEGRATION  
Line Integral – Cauchy’s theorem and integral formula – Taylor’s and Laurent’s Series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V  LAPLACE TRANSFORMS  

TOTAL: 45 PERIODS

OUTCOMES

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

TEXT BOOKS

REFERENCES

PTPH8151 ENGINEERING PHYSICS L T P C
3 0 0 3

OBJECTIVE
To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

UNIT I PROPERTIES OF MATTER
9

UNIT II ACOUSTICS AND ULTRASONICS
9

UNIT III THERMAL PHYSICS
9

UNIT IV APPLIED OPTICS
9

UNIT V SOLID STATE PHYSICS
9
Nature of bonding - growth of single crystals (qualitative) - crystal systems - crystal planes and directions - expressions for interplanar distance - coordination number and packing factor for simple structures: SC, BCC, FCC and HCP - structure and significance of NaCl, ZnS, diamond and graphite - crystal imperfections: point defects, dislocations and stacking faults - unit cell, Bravais space lattices - miller indices.

TOTAL : 45 PERIODS
OUTCOME
On completion of the course the students are expected to have a thorough knowledge on the basic physics concepts relevant to different branches of Engineering and Technology.

TEXT BOOKS

REFERENCES

PTCY8152 ENGINEERING CHEMISTRY  L T P C
3 0 0 3

OBJECTIVE
To introduce the basic chemistry concepts relevant to different branches of Engineering and Technology.

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

UNIT II POLYMER CHEMISTRY  9
Introduction: Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerisation. Types and mechanism of polymerisation: Addition (Free Radical, cationic, anionic and living); condensation and copolymerisation. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerisation: Bulk, emulsion, solution and suspension.

UNIT III KINETICS AND CATALYSIS  9

UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY  9
UNIT V  NANO CHEMISTRY  9

TOTAL : 45 PERIODS

OUTCOME:
On completion of the course the students are expected to have a thorough knowledge on thermodynamics, polymers, catalysis, spectroscopy and nanochemistry

TEXT BOOKS

REFERENCES

PTGE8151  COMPUTING TECHNIQUES  L T P C
3 0 0 3

OBJECTIVE:
To introduce the basic knowledge about computers and fundamentals of C programming.

UNIT I  INTRODUCTION  8

UNIT II  C PROGRAMMING BASICS  10

UNIT III  ARRAYS AND STRINGS  9

UNIT IV  FUNCTIONS AND POINTERS  9
UNIT V  STRUCTURES AND UNIONS
Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL : 45 PERIODS

OUTCOME:
On completion of the course the students are expected to have a thorough knowledge on computers and C programming.

TEXT BOOKS

REFERENCES

PTGE8152  ENGINEERING GRAPHICS  L T P C
3 0 0 3

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

UNIT I  PLANE CURVES AND FREE HAND SKETCHING

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III  PROJECTION OF SOLIDS
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.
UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

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

COMPUTER AIDED DRAFTING (Demonstration Only)
Introduction to drafting packages and demonstration of their use.

TOTAL : 45 PERIODS

OUTCOME:
On completion of the course the students are expected to have a thorough knowledge on design of various engineering products and technical drawings.

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.
4. The students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day.
PTMA8253 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS
(Common to all branches of B.E / B.Tech (PT) Programmes – Second Semester)

L T P C
3 0 0 3

OBJECTIVES
- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I FOURIER SERIES
9
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Parseval’s identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM
9

UNIT III PARTIAL DIFFERENTIAL EQUATIONS
9
Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange’s Linear equation – Solution of homogenous linear equations of higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS
9
Method of separation of Variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation.

UNIT V Z–TRANSFORM AND DIFFERENCE EQUATIONS
9

TOTAL: 45 PERIODS

OUTCOMES:
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes.
- To develop Z-transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

BOOK FOR STUDY

REFERENCES
OBJECTIVE
To introduce the physics of various materials relevant to different branches of technology.

UNIT I PREPARATION AND PROCESSING OF MATERIALS 9

UNIT II PROPERTIES OF CONDUCTING AND SUPERCONDUCTING MATERIALS 9

UNIT III ELECTRONIC MATERIALS 9
Elemental and compound semiconductors - Origin of band gap in solids (qualitative) - Concept of effective mass of electron and hole – carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – carrier concentration in n-type and p-type semiconductors (derivation) – variation of Fermi level with temperature and impurity concentration – Compound semiconductors – Hall effect – Determination of Hall coefficient – LED and Solar cells.

UNIT IV INSULATING AND MAGNETIC MATERIALS 9

UNIT V CERAMIC AND NEW MATERIALS 9

TOTAL : 45 PERIODS

OUTCOME:
On completion of the course the students are expected to have a thorough knowledge on the various materials and their physical properties.

REFERENCES
OBJECTIVE
To introduce the chemistry involved in various technology.

UNIT I  WATER  9

UNIT II  CHEMISTRY OF INTERFACES  9

UNIT III  OILS, FATS, SOAPS & LUBRICANTS  9
Chemical constitution, Chemical analysis of oils and fats – acid, saponification and iodine values, Definitions, determinations and significance. Definition, mechanism of lubrication, preparation of petrolubes, desirable characteristics – viscosity, viscosity index, carbon residue, oxidation stability, flash and fire points, cloud and pour points, aniline point. Semisolid lubricant – greases, preparation of sodium, lithium, calcium and axle greases and uses, consistency test and drop point test. Solid lubricants – graphite and molybdenum disulphide

UNIT IV  CHEMICALS AND AUXILIARIES  9

UNIT V  COLORANTS  9
Theory of color and constitution: chromophore and auxochrome, classification of dyes based on application. Chemistry and synthesis of, azo dye.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students are expected to have a thorough knowledge on the chemistry of water, interfaces, oils, fats, chemicals and colorants.

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

UNIT I  BASICS AND STATICS OF PARTICLES  9

UNIT II  EQUILIBRIUM OF RIGID BODIES  9

UNIT III  PROPERTIES OF SURFACES AND SOLIDS  9

UNIT IV  DYNAMICS OF PARTICLES  9

UNIT V  FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS  9
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students are expected to study the effect of force and motion in various design functions of engineering.

TEXT BOOKS

REFERENCES
OBJECTIVES:

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

UNIT I  ELECTRICAL CIRCUITS

Basic principles involved in power generation, transmission and use – Ohms Law, Kirchhoff’s Law – steady state solution of DC circuits – Theorem: Thevinin’s, Norton’s and Superposition Theorems.

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


UNIT IV  ELECTRONIC DEVICES & CIRCUITS


UNIT V  MEASUREMENTS & INSTRUMENTATION


TOTAL : 45 PERIODS

OUTCOMES:

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

REFERENCES

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

OBJECTIVES:
- 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  10
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  6
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  6
Carnot cycle; Stirlings cycle; Joule cycle; Otto cycle; Diesel cycle; Dual combustion Cycle- Derivations and problems.

UNIT IV  I.C. ENGINES, STEAM AND ITS PROPERTIES AND STEAM TURBINES  12
Engine nomenclature and classification; SI Engine; CI Engine; Four Stroke cycle, Two stroke cycle; Performance of I.C.Engine; Brake thermal efficiency; Indicated Thermal Efficiency, Specific fuel consumption.
Steam - Properties of steam; Dryness fraction; latent heat; Total heat of wet steam; Dry steam; Superheated steam. Use of steam tables; volume of wet steam, volume of superheated steam; External work of evaporation; Internal energy; Entropy of vapour, Expansion of vapour, Rankine cycle.
Steam turbines – Impulse and Reaction types - Principles of operation.

UNIT V  SIMPLE MECHANISM, FLY WHEEL, DRIVES AND BALANCING  11
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.

TOTAL : 45 PERIODS

OUTCOMES:
- Apply the law of thermodynamics to the real systems
- Understand and analyse different thermodynamic cycles, calculate their thermal efficiencies and the testing of I.C engines.
- Understand the Steam distribution and utilisation systems and comprehend principles of steam turbines
- Understand the principle of kinematic mechanics, flywheel and belt & rope drives
TEXT BOOKS

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

PTCH8302 INSTRUMENTAL METHODS OF ANALYSIS L T P C 3 0 0 3

OBJECTIVES
• To make the students acquire a sound knowledge on the principle of spectroscopy, NMR, chromatography and its application

UNIT I INTRODUCTION OF SPECTROMETRY 9

UNIT II MOLECULAR SPECTROSCOPY 9

UNIT III MAGNETIC RESONANCE SPECTROSCOPY AND MASS SPECTROMETRY 9

UNIT IV SEPARATION METHODS 9

UNIT V ELECTRO ANALYSIS AND SURFACE MICROSCOPY 9

TOTAL : 45 PERIODS
OUTCOMES:
- Understand the working principle and application of spectroscopy
- Understand the NMR principle and its application
- Understand the chromatography principle and its application
- Understand the fundamentals of electro analysis and surface microscopy

TEXT BOOK

PTCH8303 ORGANIC CHEMISTRY

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

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

UNIT II HETEROCYCLIC COMPOUNDS
Preparation, Physical & Chemical properties and Uses of Pyrrole, Furan, Furfural, TetrahydroFuran, Thiophene, Indole, Pyridine, Quinoline and Isoquinoline.

UNIT III DYE CHEMISTRY
Witt’s theory and modern theory of colors – Synthesis of Methyl red, Methyl orange, Congo red, Malachite green, para-rosaniline, phenolphthalein, fluorescence, Eosin dyes.

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

UNIT V PHARMACEUTICAL CHEMISTRY

TOTAL : 45 PERIODS

OUTCOMES:
- Understand the classification of carbohydrates and preparation of heterocyclic compounds.
- Understanding the dye chemistry and synthesis of dyes.
- Apply the concept to prepare organic compounds and synthesis the ant malarial and Antibacterial drugs.

TEXT BOOKS

REFERENCE BOOKS
OBJECTIVES

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

UNIT I
Units, dimensions and conversion; Process variables and properties; Stoichiometric Equations, Degrees of freedom.

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

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

UNIT IV

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

TOTAL: 45 PERIODS

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.

TEXT BOOKS

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

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

UNIT II TRANSVERSE LOADING ON BEAMS 9

UNIT III DEFLECTIONS OF BEAMS 9
Double integration method – Macaulay’s method – Area – moment theorems for computation of slopes and deflections in beams.

UNIT IV STRESSES IN BEAMS 9

UNIT V TORSION AND COLUMNS 9

TOTAL : 45 PERIODS

OUTCOMES
• 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 precurs or for the study on process equipment design and drawing.

TEXT BOOKS

REFERENCE
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.

TEXT BOOKS

REFERENCES
OBJECTIVES

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

UNIT I

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

UNIT II

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

UNIT III

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

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


20
OBJECTIVES

• Students will be able to understand various material and its properties and manufacturing methods.

UNIT I    INTRODUCTION


UNIT II    MECHANICAL BEHAVIOUR


UNIT III    PHASE DIAGRAMS AND PHASE TRANSFORMATIONS


UNIT IV    FERROUS, NON-FERROUS METALS AND COMPOSITES

| Pig iron, Cast iron, Mild Steel-Manufacturing process, properties &, Applications Stainless steels, Special Alloy steels-properties and uses; Heat treatment of plain-carbon steels. Manufacturing methods of Lead, Tin and Magnesium. Properties and applications in process industries. FRP-Fiber Reinforced Plastics (FRP), manufacturing methods; Asphalt and Asphalt mixtures; Wood. |

UNIT V    NANOMATERIALS


OUTCOMES:

• Understand basic and the mechanical behavior of the metals
• Understand phase diagrams and phase transformations of metals.
• Understand the manufacturing process of ferrous, non-ferrous metals and composites.
• Understand the basic concepts of nano materials

TEXT BOOKS

4. Material Science & Engineering, Callister

REFERENCES

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
OBJECTIVES

- To acquire knowledge in the field of electrochemistry, solubility behaviour, chemical reaction kinetics, photochemical reactions and colloidal chemistry towards different applications.

UNIT I  ELECTROCHEMISTRY  9

UNIT II  CHEMICAL KINETICS  9

UNIT III  PHOTOCHEMISTRY  9

UNIT IV  COLLOIDS  9

UNIT V  THE DISTRIBUTION LAW  9

TOTAL: 45 PERIODS

OUTCOMES:
- Understand the basic principles of electrochemistry and colloids to apply for their application in Chemical Engineering practice.
- Understand kinetics and theory of reaction rates concepts
- Understand the fundamentals of photochemistry and the concept of distribution law.

TEXT BOOKS

REFERENCES
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
9. Centrifugal pump
10. Packed column
11. Fluidized bed

TOTAL : 45 PERIODS

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

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

REFERENCES

PTCH8502 CHEMICAL REACTION ENGINEERING - I L T P C
3 0 0 3

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

TEXT BOOKS

REFERENCE
PTCH8503 CHEMICAL TECHNOLOGY L T P C 3 0 0 3

OBJECTIVES
• 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

TOTAL : 45 PERIODS

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.,

TEXT BOOKS

PTCH8504 HEAT TRANSFER L T P C 3 0 0 3

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

TOTAL : 45 PERIODS

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

PTCH8505 MASS TRANSFER I  L T P C
3 0 0 3

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 diffusional operations and theories of mass transfer
- Understand the concept of interphase 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

TEXT BOOKS

REFERENCES

PTCH8511 MECHANICAL OPERATIONS LABORATORY  L T P C  0 0 3 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.

TOTAL : 45 PERIODS

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.

PTCH8601 CHEMICAL REACTION ENGINEERING - II L T P C
3 0 0 3

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

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

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

UNIT IV GAS-SOLID NON-CATALYTIC REACTORS
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 GAS-LIQUID REACTORS
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

PTCH8602 MASS TRANSFER II

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, tray efficiency, tower diameter; 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-packed bed extraction with reflux. Pulsed extractors, centrifugal extractors-Supercritical extraction

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

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

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.

TEXT BOOKS

REFERENCES

PTCH8603 PROCESS EQUIPMENT DESIGN  L T P C  
3 0 0 3

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

OBJECTIVES:
- Students learn to do in detail process and mechanical design and engineering drawing of different chemical engineering equipments.

UNIT I
Heat Exchangers, Condensers, Evaporators 

UNIT II
Cooling Tower, Dryers 

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

UNIT IV
Packed bed Reactors, Pressure Vessel, Storage Vessel 

UNIT V
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.
REFERENCES

PTCH8604 PROCESS INSTRUMENTATION, DYNAMICS AND CONTROL L T P C 3 0 0 3

AIM
To familiarize the students with concepts of process dynamics and control leading to control system design.

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 6
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 11
Laplace transformation, application to solve ODEs. Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag.

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

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

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

TOTAL : 45 PERIODS

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
TEXT BOOKS

REFERENCES

PTCH8611 HEAT AND MASS TRANSFER LAB L T P C
0 0 3 2

OBJECTIVES
To impart knowledge on heat transfer operation by practice

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

EQUIPMENTS 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

LIST OF EXPERIMENTS
1. Separation of binary mixture using simple distillation
2. Separation of binary mixture using Steam distillation
3. Separation of binary mixture using Packed column distillation
4. Measurement of diffusivity
5. Liquid-liquid extraction
6. Drying characteristics of Vacuum Dryer
7. Drying characteristics of Tray dryer
8. Drying characteristics of Rotary dryer
9. Water purification using ion exchange columns
10. Mass transfer characteristics of Rotating disc contactor
11. Estimation of mass/heat transfer coefficient for cooling tower
12. Demonstration of Gas – Liquid absorption

EQUIPMENTS REQUIRED
1. Simple distillation setup
2. Steam distillation setup
3. Packed column
4. Liquid-liquid extractor
5. Vacuum Dryer
6. Tray dryer
7. Rotary dryer
8. Ion exchange column
9. Rotating disc contactor
10. Cooling tower
11. Absorption column

Minimum 10 experiments shall be offered.

OUTCOMES
• Students develop a sound working knowledge on different types of heat transfer equipments.

TOTAL: 45 PERIODS

PTCH8701    PROCESS ECONOMICS     L T P C
3  0  0  3

OBJECTIVES
• Students will acquire the knowledge about the process economics

UNIT I    INTRODUCTION

UNIT II    CONSUMER AND PRODUCER BEHAVIOUR

UNIT III    PRODUCT AND FACTOR MARKET

UNIT IV    PERFORMANCE OF AN ECONOMY – MACRO ECONOMICS

UNIT V    AGGREGATE SUPPLY AND THE ROLE OF MONEY
OUTCOMES:
- Understand the basic themes of economics
- Understand the consumer and producer behavior
- Understand the different market structures
- Analyse the Economics

TEXT BOOKS

PTGE8251 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
(common to EEE, Civil, Printing, Industrial, Mechanical, Manufacturing, Production, CSE, IT, Chemical, Textile) 3 0 0 3

OBJECTIVES
- Students acquire knowledge about the environment, ecosystems and biodiversity

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

UNIT II ENVIRONMENTAL POLLUTION 8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.
UNIT III  NATURAL RESOURCES

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

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT


UNIT V  HUMAN POPULATION AND THE ENVIRONMENT


TOTAL : 45 PERIODS

OUTCOMES:

• Understand the environment, ecosystems and biodiversity
• Understand the natural resources available in the earth and how it get polluted
• Understand the influence of social issues and human population on the Environment

TEXT BOOKS:


REFERENCES

OBJECTIVES
To initiate the ability of doing a complete plant design.

OUTCOMES
- The objective of the project is to make use of the knowledge gained by the student at various stages of the degree course.
- 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, out side the department, in industries/Research labs for which proportional weightage will be given in the final assessment.

PTCH8001 BIOCHEMICAL ENGINEERING

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, ultra filtration and reverse osmosis),chromatographic separation-gel permeation chromatography, electrophoresis, final steps in purification –crystallization and drying.

TOTAL : 45 PERIODS
OUTCOMES:
- Apply the knowledge of microorganisms 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

PTCH8002 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; condensation and 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; parenteral solutions, oral liquids; injections; ointments; standard of hygiene and manufacturing practice. Packing; packing techniques; quality control.
UNIT V  PHARMACEUTICAL PRODUCTS & PHARMACEUTICAL ANALYSIS  9
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

PTCH8003  ELECTROCHEMICAL ENGINEERING  L T P C
3 0 0 3

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

UNIT I  9

UNIT II  9
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  10

UNIT IV  8
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:
- Understand 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

PTCH8004 ENERGY TECHNOLOGY

OBJECTIVES
- Students will gain knowledge about different energy sources

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

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

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

UNIT IV BIOMASS ENERGY
Biomass origin - Resources – Biomass estimation. Thermochemical conversion – Biological conversion, Chemical conversion – Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, integrated gasification.
UNIT V ENERGY CONSERVATION 9
Energy conservation - Act; Energy management importance, duties and responsibilities; Energy audit – Types methodology, reports, instruments. Benchmarking and energy performance, material and energy balance, thermal energy management.

TOTAL : 45 PERIODS

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

TEXTBOOKS

REFERENCES

PTCH8005 MODERN SEPARATION TECHNIQUES L T P C
3 0 0 3

OBJECTIVES
• Students will gain knowledge about recent separation methods

UNIT I BASICS OF SEPARATION PROCESS 9
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 9
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 9
Types and choice of Adsorbents, Adsorption Techniques, Dehumidification Techniques, Affinity Chromatography and Immuno Chromatography, Recent Trends in Adsorption.

UNIT IV INORGANIC SEPARATIONS 9
Controlling factors, Applications, Types of Equipment employed for Electrophoresis, Dielectrophoresis, Ion Exchange Chromatography and Eletrodialysis, EDR, Bipolar Membranes.
UNIT V  OTHER TECHNIQUES  9
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

REFERENCES

PTCH8007  PETROLEUM REFINING AND PETROCHEMICALS  L T P C
3 0 0 3

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

UNIT I  9

UNIT II  9
Cracking, Thermal Cracking, Vis-breaking, Catalytic Cracking (FCC), Hydro Cracking, Coking and Air Blowing of Bitumen.

UNIT III  9
Treatment Techniques: Removal of Sulphur Compounds in all Petroleum Fractions to improve performance, Solvent Treatment Processes, Dewaxing, Clay Treatment and Hydrofining.

UNIT IV  9
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  9
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.

TOTAL : 45 PERIODS
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:

PTCH8008 PLANT SAFETY AND RISK ANALYSIS L T P C 3 0 0 3

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

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

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

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

UNIT III
Over all risk analysis–emergency planning-on site & off site emergency planning, risk management ISO 14000, EMS models case studies. Quantitative risk assessment - rapid and comprehensive risk analysis; Risk due to Radiation, explosion due to over pressure, jet fire-fire ball.

UNIT IV
Hazard identification safety audits, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazan past accident analysis Fixborough-Mexico-Madras-Vizag-Bopal analysis

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

TOTAL : 45 PERIODS
OUTCOME:
- 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 bio medical and engineering response to health hazards and to implement the effective process control and instrumentation.

TEXT BOOKS:

REFERENCES:

PTCH8009  POLYMER TECHNOLOGY  L T P C
3 0 0 3

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

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

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

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

UNIT IV PROCESSING OF POLYMERS
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
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.

REFERENCES:

PTCH8010 PROCESS MODELLING AND SIMULATION L T P C
30 03

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

UNIT I INTRODUCTION
3
Introduction to modeling and simulation, classification of mathematical models, conservation equations and auxiliary relations.

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

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

UNIT IV STEADY STATE DISTRIBUTED SYSTEM
7
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
13

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

REFERENCES

PTCH8011 PROCESS PLANT UTILITIES LTPC 3 0 0 3

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

UNIT I IMPORTANT OF UTILITIES
9
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
9
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
9
Refrigeration Cycles, Methods of Refrigeration used in Industry and Different Types of Refrigerants such as Monochlorodifluoro Methane, Chlorofluoro Carbons and Brins. Refrigerating Effects and Liquefaction Processes.

UNIT IV COMPRESSED AIR
9

UNIT V FUEL AND WASTE DISPOSAL
9

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:

PTGE8071 DISASTER MANAGEMENT L T P C 3 0 0 3

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

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

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)
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 Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation-IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.
UNIT IV  DISASTER RISK MANAGEMENT IN INDIA  9
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V  DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS  9
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

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

TEXTBOOKS:

REFERENCES
1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

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

UNIT V

TOTAL : 45 PERIODS

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

REFERENCES: