B.E. – I

B.E. CHEMICAL -1.
(FIRST SEMESTER)

(1) APPLIED PHYSICS-1

(1) Interference:-
Types of interference, Fresnel's biprism, White light fringes, Determination of thickness of thin sheet, Interference in thin films (conditions for normal incidence). Necessity of extended source, Newton's rings, Mechelson interferometer, Types of fringes, Uses of Michelson interferometer, Antireflection coating, interference filters.

(2) Diffraction:-
Fraunhoffer diffraction at a circular aperture, Plane diffraction grating, Formation of multiple spectra and determination of wavelength. Dispersive power of grating, Resolving power of grating prism, telescope and microscope.

(3) Geometry of calcite crystal, Double refraction, Nicol's prism, Huygene's theory of double refraction, quarter wave plate, Half wave plate, Elliptically and circularly polarized light and production of circularly polarized light, Optical activity, Specific rotation, Fresnel's theory of optical rotation, Laurent's half-shade polarimeter, Photoelasticity.

(4) Lasers:-
Spontaneous & Stimulated emission, Population inversion, Structure of a laser, Properties of laser light (monochromatic, low divergence, coherence.) Types of Laser with specification Applications.

(5) Ultrasonic:-
Ultrasonic waves, Production and detection, Properties of ultrasonic Application of Ultrasonic waves.

(6) Electricity and Magnetism:-
Magnetic forces on a current, Torque on a current loop, Hall effect and Hall devices Circulating charges, Cyclotron and mass spectrometer, Faraday's law of induction. Lenz's Diamagnetism Ferrmagnetism, Nuclear magnetism and NMR.

(7) Thermoelectricity:-
Seebeck effect, Variation of thermo-emf with temperature, Thermoelectric series, Measurement of thermo-emf, Law of intermediate metals, Law of intermediate temperatures. Peltier effect, Thomson effect, Total emf in a thermocouple, Thermoelectric power, Applications of thermoelectric effect.

(8) Modern Physics:-
Artificial radioactivity, Artificial transmutation, Nuclear reactions and Q-value. Types of nuclear reaction, Structure of nucleus, Nuclear constituents, Proton-neutron theory, General properties of nucleus, Atomic mass unit. Mass defect and packing fraction, Nuclear binding energy, Nuclear forces, Nuclear models.

(9) Nuclear Fission:-
Theory of nuclear fission, Energy released in nuclear fission, The chain reaction Thermonuclear reactions, Atom bomb, Stellar energy, Nuclear reactions.

(10) X-rays:-
Discovery & production of x-rays, Origin and properties of x-rays, Diffraction of x-rays Bragg's Law, x-rays spectrometer and crystal structure. Powder method, Applications of x-rays.

PRACTICLAS:-
Practical based on the above syllabus.

(2) APPLIED MATHEMATICS:-

(1) Infinite Series:-
Sequences of their convergence. Convergence and divergence of infinite series Geometric series, Necessary condition for convergence, Comparison test, Ratio test Absolute convergence and conditional convergence.

(2) Functions of One Variable:-
Application of derivatives – Curvature, Successive derivatives, Leibnitz Rule for nth derivatives.
Rolle's theorem, Mean value theorem, Expansion of functions. Taylor's expansion with remainder form, Indeterminate forms, L'Hospital's Rule.

(3) Complex Algebra:-
Complex numbers, Demovier's theorem and its application, Hyperbolic, Exponential and Logarithmic functions.

(4) Differential Equations:-
Formation of differential equation form a given solution. First order first degree diffetren

B.E. 1 (SECOND SEMESTER)

APPLIED CHEMISTRY : - I

Marks: 100 L- , Pr.-

1. Positive ray analysis, Mass spectrograph, artificial disintegration, induced radioactivity, application of radio isotopes, atomic fission, atomic fusion. Electrical conductivity of a solution, transport number of an ion strong electrolytes, Chemical kinetics: - First and second order reactions.

2. Phase rule and its applications to water, sulfur and binary solid-solid systems. Crystal structure, applications of I-rays to crystal structure.

3. Water for industrial and boiler feed purpose, demineralization of water.

4. Fuels:- Proximate and ultimate analysis of fuels, rocket fuels

5. Corrosion, passivity, paints, pigments, varnish, lime, mortar, cement, ceramics, adhesives, abrasives, refractories, lubricants, Silicon, Silicate, Industrial explosives.

6. Buffer solutions , theory of indicators

7. Organic compounds :- Detection of elements, Principles of organic chemistry as illustrated by the study of representative compounds. Concept of covalent bond, sigma and pi bonds.

8. Method of determination of molecular weight, Applications of the law of mass action to homogeneous equilibria. Ostwald's dilution law.

References:

APPLIED MECHANICS

Marks: L- , Pr.-

(A) MECHANICS:-

1. Force and motion of Translation:-
   Newton's laws of motion, force and linear acceleration, pulsive and impulsive force, conservation of momentum (work & power), energy (conservation of energy), Motion up a rough incline plane.
2. Force and motion of Rotation :-
   Couple, couples and angular accerlations, angular momentum, moment of inertia, work done by a couple, Kinetic energy of rotation, Wheel rolling down on inclined plane, Truck rolling down inclined plane fly wheels.
3. Rigid bodies in motion:-
   Motion along a level track, Motion round a curve-superelevation

(2) Smithy:-

Tools used for preparing simple jobs in hand forging.

TERMWORK:-

Each candidate shall submit to the examiners , the termwork as mentioned below which will be allotted marks upto a maximum of 50 with a certification from the Dean, Faculty of Technology and Engineering that it was completed by him in satisfactory manner within the walls of the college.

Carpentry:- At least 4 different joints
Smithy:- At least 4 different jobs

When once a set of jobs has been submitted for the examination and marks will be carried over to a subsequent examination unless new jobs are presented. A candidate whose marks in termwork are thus carried over shall be eligible for a class.

(B) THEORY OF MECHANICS:-

1. Friction:-
   Friction, Equilibrium on rough inclined plane, The wedge, The Jack screw

2. Lifting Machines:-
   Basic Machines, The differential principles, pulley block, crab winches, work gearing, wormed geared screwjack, worm geared pulley block, linear law efficiency.

3. Bolt and rope drives:-
   Belt drive, velocity ratio, Compound belt drive, Length of belt, Transmission of power, Centrifugal tension-rope drive
4. Toothed gearing:-

Train of wheels, simple and compound, Design of wheel trains, Epicyclic gearing, Speed reduction gear, Differential gear.

(C) GRAPHIC STATICS:-

1. Coplanar forces and Couples:-
   Coplanar forces acting at a point, force polygon, Resultant or forces and a couple, Equilibrium of coplanar forces, Funicular polygon, Parallel forces, Center of gravity and moment of inertia, Reaction at different types of supports.
2. Static of simple frames:-
   Equilibrium of frame work of jointed rods, Perfect frame with any type of loading, Cantilever trusses and space frames.

(D) STRENGTH AND ELASTICITY OF A MATERIAL:-

1. Simple stress and strain:-
   Hook's Law, Elastic limit, Ultimate stress, Factor of safety, Lateral strain, Poisson's ratio, Stress concentration idea, Temperature stress, Simple shear Elastic Module relation.

References:

TERMWORK
Laboratory Work: A minimum of ten experiments
Graphic Static: A minimum of ten exercise problem based on above topics

Laboratory work shall be presented by the candidate in the form of a laboratory journal.
The graphic static work shall be presented by the candidate in the form of a Drawing file.

APPLIED MATHEMATICS :- II

Marks: L- , Tu-

1. Partial Differentiation:-
   Function of Two Variables, Definition, limit, continuity and partial derivatives, chain rule, Euler's theorem, Implicit functions, Differentials, Application of partial derivatives, Tangent plane and normal line, tangent line normal plane, approximation, maxima & minima, LaGrange's multiplier's method, envelopes.

2. Partial Differential Equations:-
   Formation of first order partial differential equations, Solutions of first order partial differential equations

3. Vector Differentiation:-
   Scalar and vector fields, gradient of a scalar function, Directional derivative, Divergence and curl of a vector field and their application.

4. Analytical Geometry (A Vector Approach):-
   Equation of a straight line, Distance of a point from a line, Standard equation of plane, Obtaining a equation of a plane from given conditions, Perpendicular distance of a point from a plane and its applications, System of planes, Symmetric form of a line and coplanar lines.

   Sphere: Standard equations of sphere, Tangent plane to a sphere, System of sphere.
   Cone: Guiding curve method, Enveloping cone, Right circular cone
   Cylinder: Guiding curve method, Enveloping cylinder, Right circular cylinder

5. Matrices:-
   Rank of matrix, Solution of homogeneous and non-homogeneous systems of linear equations, Eigen values and Eigen vectors of a matrix and their properties, bounds for Eigen values.

References:

CHEMICAL ENGINEERING ORENTATION

Marks: L- , Tu- ,

1. Introduction to chemical engineering;
   - Basic of Chemical Engineering
   - Basic laws and theories used in chemical engineering
   - Application of Chemical Engineering Science, Opportunities for a chemical engineer, Literature survey

2. Units & Dimensions :-
   - Different types of units, conversion factors, dimensional analysis

3. Mathematical and general procedures in chemical engineering, Types of graph papers, graphical integration and graphical differentiation
4. Concept of unit operations and unit processes.
5. Concept of Transport Phenomena, Unified treatment of Chemical Engineering Operations
6. Continuous contact equipment, stage vise contact equipment.
7. Overview of the Indian Chemical Industry with emphasis on raw materials.
8. New frontiers of Chemical Engineering
9. Principles of various laboratory equipment like pH meter, Refractometer, Conductivity meter, Spectrophotometer etc.

References:

INSTRUMENTAL METHODS OF ANALYSIS

Marks: L- , Tu-

1. Construction and working of analytical electromagnetic balance.
2. Introduction to principle, construction and working of Abbe's and Immersion Refractometers.
3. Operation of Abbe's Refractometer, Determining refractive index of different solutions and their mixtures.
4. Introduction to principle, construction and working of pH meter.
5. Operation of pH meter, Determining pH of different solutions and buffer solutions
6. Introduction to principle of potentiometric titration, Titration of FeSo4 solution against KMnO4 solution using a pH meter.
7. Introduction to principle, construction and working of conductivity meter
8. Operation of a conductivity meter, Determining conductivity of different solutions, acid base titration using conductivity meter.
9. Introduction to the principle of visible, UV and IR spectrophotometer
10. Operation of visible and UV spectrophotometer.
11. Classification of different types of Chromatograph, techniques, principle and working of Gas-Liquid chromatograph.
12. Operation of Gas- Liquid chromatograph, Determining composition of a liquid mixture.

References:

BE I (SECOND SEMESTER)

REVISED SYLLABUS

SUB: INTRODUCTION TO CHEMICAL ENGINEERING

L – 3, T – 1 *Marks - 100*

(A) Essentials of Chemical Engineering

- **Chemical Process Industry & its segments**
  - Chemical Engineering: - History & Development, Concept of Unit Operation & Unit Processes as building blocks
  - Role of Chemical Engineer
  - Information: Literature & Data Sources (Assignment oriented)

(B) Material & Energy Balances

- Units, dimensions and conversions
- Basic laws including Principles of Transport Phenomena, Thermodynamics & Chemical Kinetics
- Problem solving and calculation techniques: Analytical, Graphical and Numerical
- Property calculations for Gases/Vapors, liquids, and solids: Density, Molecular weight, concentrations, composition variables, Vapor pressure, humidity, energy forms, enthalpy etc.
- Flow sheet representation of UO, UP and manufacturing processes, representation of material & property quantities associated with flow sheets

Reference Books:

1) 'Introduction to Chemical Engineering', by Ghoshal, Sanyal & Datta
2) 'Basic Principles & Calculation in Chemical Engineering', by Himmelblau D.M (Vith Edi)
3) 'Elementary Principles of Chemical Processes', by Felder (IIIrd Edi)

BE I (SECOND SEMESTER)

REVISED SYLLABUS

SUB: INSTRUMENTAL METHODS OF ANALYSIS

(Practical & Term work)

Pr & Tw – 4 hrs per week **Marks – 50**

- Construction and Working of Single Pan Balance
- Principle, construction and working of Abbe's & Immersion Refractometers
  Determination of refractive indices of various solutions
- Principle, construction and working of pH Meter
  Determination of pH of different solutions and buffers
- Principle of Potentiometric Titration, Titration of $FeSO_4$ solution against $KmnO_4$ solution using a pH meter
- Principle, construction and working of Conductivity Meter
  Determination of conductivity of different solutions
- Principle & operation of Visible, UV, IR spectrophotometer and Raman Spectroscopy
- Verification of Beer's and Lambert's Laws. Determination of concentration of solute in a solution using visible spectrophotometer
- Classification of different types of Chromatography techniques
- Principle, operation and working of various chromatographs
  Determination of composition of a liquid mixture using a GLC
- Sampling Techniques
- Errors, Precision & Accuracy

Reference Books:

1) 'Instrumental Methods of Chemical Analysis' by Chatwal & Anand

B.E. – II

B.E. II (First Semester)

Process Calculations: L-3, Tu-1, TW-2

1. Mathematical Techniques in Chemical Engineering, Stoichiometric relations.
2. Gas laws and phase equilibria
3. Humidity, Saturation and Crystallization
4. Combustion and chemical processes
5. Material Balances involving recycle, Bye pass and purge systems
6. Thermodynamics: Heat capacity, Latent heats and calculation for sensitive and latent heat changes.
7. Enthalpy changes of reactions, dissolution and laws of thermochemistry.
8. Effect of pressure and temperature on heats of reactions, reaction temperatures.
9. Combined material and energy balances for single stage processes.
10. Material and Energy balance calculations for typical industrial processes.

B.E.-II (Second Semester)

Applied Mathematics-IV
(Introduction to Computer and Numerical Analysis)

Marks: 100 L-3, Tu-1

1. Introduction to Computers:
   Basic characteristics of a digital computer, organization of a digital computer, Step involved in problem solving in computers, machine, assembly and higher-Level language, Algorithm, Effective procedure techniques in problem solving, Flowcharts, pseudo-code, use of computers in Pharmacy.

2. FORTRAN Programming:

3. Numerical Analysis and Application Programming:
   a. Finite differences, Newton's Interpolation, Numerical integration, Trapezoidal Rule, Simpson's Rule.
   b. Solution of equation with one variable, Regula-falsi, Secant method, Newton-Raphson method.
   c. Solution of systems of linear equation: Gauss-Seidal, Jacobi, Gauss-elimination method.
   d. Numerical solution of Differential equation: Picard's method, Runga-Kutta method, Euler's method.

References:

Energy Technology

Marks: 100 L-3, Tu-1

1. Energy forms, Sources and Resources.
2. Solid, Liquid and Gaseous fuels, their specification and classification.
3. Carbonization, Gasification and Hydrogenation of solid fuel.
4. Fuel cells and Magnetohydrodynamics.
5. Solar Energy and its conversion.
6. Wind Energy.
7. Water Power: Tides, Waves and Currents.
8. Nuclear Energy: Fission Power and Fusion.
9. Energy Storage and other developments.

References:

- "Non Conventional Energy Technology", G. D. Rai, IInd M.M. El Wakil
- G.D. Rai

Physical Chemistry

Marks: 100 + L-3, Tu-1, Pr-

1. Properties of liquid and solutions, viscosity, surface tension, molecular refractivity, optical rotation, dipole moment, molecular structure and chemical constitution.

2. Equilibria and Kinetics: Arrhenius equation, Activation energy, Order of reaction, First and Second order reactions.

3. The Phase Rule, One and two component systems (solution of liquids in liquids and solids in liquids).

4. Distribution law, Adsorption, Colloidal systems, Emulsions and foams, Sols and gels.

5. Photochemistry: Type of Spectra, Photo-excitation of molecules, Laws of photochemistry.

6. First and second laws of thermodynamics (Enthalpy, Entropy and Free energy).

7. Chemical Equilibrium, Voltaic cell, Single electrode potentials, Concentration cells, Oxidation-reduction potentials, Standard electrodes, Fuel cell.

References:

Fluid Flow Operations

Marks: 100+50=150 L-3, Tu-1, Pr-3

1. Nature of Fluids, Concept of viscosity, Viscometers, Fluid statics, Manometers, Pressure measurements.

2. Introduction to fluid dynamics, Classification of fluids, Concept of potential flow, Stream lines, Average velocity, Mass velocity etc., Reynolds number and its significance, Laminar and Turbulent flow, Equation of continuity, Bernoulli's Theorem.

3. Frictional losses in closed channels and pipe fittings, Contraction and expansion losses, Power requirement for flow. Flow through packed bed.

4. Flow meters: Rate and Quantity meters

5. Fluid moving machinery: Centrifugal and Positive displacement pumps.

6. Two-phase gas liquid flow in pipes.

7. Turbulent flow and theory of turbulence;

8. Introduction to compressible flow, flow through pipes and nozzles, Fans , blowers and compressors.

Practicals:

- Friction in Circular Pipe
- Friction in Annulus
- Orificemeter
- Friction in Packed Bed
- Viscosity by Stokes Law
- Viscosity by Efflux time
- V-Notch
- Characteristics of Centrifugal Pump

References:

- Unit Operations; Mcabe-Smith
- Vol.-II; Richardson-Coulson

Theory of Machines & Machine Design

Marks: 100 L-3, Tu-1

1. Theory of Machines:
   a. Machines and mechanisms, Links, Lower and higher pairs, Four bar mechanism, Slider crank mechanism and its inversions.
   b. Velocity and acceleration of simple mechanisms, Graphical and analytical method.
   c. Cam profile for different kinds of motions.
   d. Gears: Types of applications, Kinematics of gears, Balancing of rotating masses (simple cases), Fly Wheel.

2. Elements of Machine Design:
   a. Designing function, Materials for machine components, Factor of safety, Types of loading, Types of stresses, Stress concentration, Fatigue loading on machine parts.
   b. Design of machine members: Cotter and Knuckle joints, Turnbuckle, Couplings, Shafts, Keys, Springs, Levers.
   c. Design of fasteners, Loading on bracket bolts.

Termwork:

Based on the above syllabus: Tutorials on topics of Theory of machines and machine design and drawing sheets.

References:

Energy Technology and Thermodynamics

Marks: 100 L-3, Tu-1

1. Laws of thermodynamics, thermodynamic functions & their inter-relations
2. Property estimation/calculations (U H S G etc) and property charts
3. Thermodynamics of flow processes and power generation
4. Refrigeration and Liquefaction
5. Exergy / lost work analysis
6. Energy forms, Sources and Resources.
7. Solar Energy Wind Energy and Tidal power
8. Fuel cells and Magnetohydrodynamics.
9. Nuclear Energy: Fission Power and Fusion.
10. Energy Storage and other developments.

B.E. – III

FIRST SEMESTER B.E. III

Transport Phenomena

Marks 100 **L3- Tu 1**

1. The role of transport Phenomena in the understanding of Chemical Engineering.
2. Fluids, classification, Transport properties, Introduction to non-Newtonian fluids, two parameter models.
3. Lagrangian and Eulerian concept of motion, control volume approach, overall and differential Mass Balances in Cartesian Cylindrical and polar co-ordinate systems.
4. Shell momentum balance approach: Application to selected problem.
5. Equation of Motion and its applications.
6. Boundary Layer theory, von Karmans analysis, exact solutions using stream functions.
7. Turbulence, concepts, Mixing length hypothesis, universal velocity profile, applications.
8. Shell energy balance approach: Applications to selected problems.
9. Convective Heat transport: Asymptotic solutions of typical flow problems, etc.
10. Fick's law of diffusion, application of differential balances to mass transfer, critical analysis correlations for mass transfer.
11. Mass transfer theories, Convection- Diffusion problems in homogenous and heterogeneous Media.
12. Analogy between Momentum, heat and mass transfer.

Books:-

1. Transport Phenomena - by Bird Stewart and Lightfoot

GENERAL CHEMICAL TECHNOLOGY - I

Marks 100 + 50 **L-3, Tu-1,Pr-3**

1. Chemical Industries in India: - An overview, Unit Process concept, Flow sheet symbols.
2. Industrial Gases: - O_2, N_2, Ar and C_2H_2
3. Industrial Acids: - H_2SO_4, HNO_3, HCl, H_3PO_4
4. Fertilizers: - Nitrogenous and Phosphatic
5. Salts: - Soda Ash and Caustic Soda
6. Cement and lime, Glass and ceramics, Oils and fats, paints, soaps and detergents.
7. Sugar, Wood chemicals: - pulp and paper
8. Iron, Steel and Aluminum, Copper, Lead, Zinc and Coal Chemicals

Books:-

1. Chemical process Industries by N.R..Shreve
2. Outline of Chemical Technology by C. Dryden
3. Unit process of Organic Synthesis by P.Groggins.
4. Chemical Technology by Bhaskaran

Heat Transfer Operations

Marks 100 + 50 **Th-3, Tu-1, Pr-3**

1. Modes of heat Transfer, Heat transfer by conduction (Steady State) analytical and numerical methods for flat, cylindrical and spherical geometry. General differential equation for heat conduction. Extended surface heat transfer, Insulation.

2. Heat transfer by convection- Physical significance of dimensionless numbers, Free & Forced convection, Film & Overall heat transfer coefficients (Concept of convective resistances in series). Laminar & turbulent flow heat transfer inside & Outside the tubes. Theoretical background to laminar and turbulent flow heat transfer.

3. Double pipe heat exchangers: parallel and counter flow heat transfer, LMTD, Series & Parallel connections of heat exchanger, shell & tube heat exchanger calculations.
4. Heat transfer with phase change. Heat transfer to boiling liquids & from condensing vapour.
5. Heat transfer in agitated vessel- steady & unsteady state heat transfer.
6. Heat transfer by radiation.
7. Luminous & non-luminous gases, combined mode of heat transfer, pipe still furnaces.
8. Plate, spiral, scraped surface heat exchangers, packed bed heat transfer.
9. Evaporation, types of evaporators and their feed arrangement. Evaporator calculations.

Books: -

1. Process Heat Transfer - by D.Q.Kern
2. Heat transfer - by Y.V.C. Rao
3. Heat & Mass Transfer - by R.C.Sachdeva

CHEMICAL ENGINEERING THERMODYNAMICS

Marks 100 **L-3, Tu-1**

1. Thermodynamic functions and relations for mixtures:
   Partial molar property, chemical potential, residual properties, fugacity & fugacity coefficients, excess functions and activity coefficients, correlations for excess Gibbs free energy.
2. PVT behavior including EOS for mixtures; Fugacity estimation/ calculations based on PVT behavior

3. Phase equilibrium criteria and VLE calculations for different pressure ranges including flash calculations.
4. Activity coefficient calculation from experimental VLE data and data reduction, applications of Gibbs-Duhem relation for calculations of and consistency check for VLE data.
5. Phase diagrams for miscible, partially miscible and immiscible liquid mixtures, introduction to LLE and VLLE calculations.
6. Criteria of chemical equilibrium, effect of P and T on equilibrium conversion (Xe) and equilibrium constant (K), methods of evaluation of K & Xe, Xe charts for Exothermic, Endothermic, Reversible and irreversible reactions etc.
7. Equilibrium of complex reactions, introduction to equilibrium conversion calculation under adiabatic and non-isothermal conditions, introduction to liquid phase, Heterogeneous and Electrochemical reaction equilibria, Thermodynamic analysis of some chemical reactions of industrial importance.
8. Prediction of thermodynamic properties by group contribution and other methods.

Books:

1. Introduction to Chemical Engineering Thermodynamics (6^{th} Ed.)
   - Smith J.M., H.C. Van Ness, M.M. Abott.
2. Chemical Engineering Thermodynamics – Y.V. C. Rao
3. Chemical Engineering Thermodynamics – K.V. Narayanan

MASS TRANSFER OPERATIONS I

Marks: 100 + 50 ***L-3, Tu-1, Pr-3***

Molecular diffusion in fluids, Theories of Mass Transfer, Prediction of diffusion coefficients for gases and liquids.
Fundamentals of Mass transfer, Mass transfer coefficients interphase mass transfer.
Gas- liquid equilibria, gas absorption, solvent selection criteria, analysis of absorption columns, graphical design of plate columns, Kremsers Soudres & Browns method.
Packed column design for gas absorption.
Humidification and dehumidification: Basic concepts, cooling towers, cooling tower design by ethalpy potential method.
Drying: Concepts, calculations of rate of drying, Classification Selection & design of drying equipment.
Adsorption & Ion exchange: Equilibria, stagewise adsorptions, continuous contact adsorption & ion exchange.
Crystallization: Concepts, theories of nucleation & crystal growth, calculation of yield, crystallization equipment.

Books

1. Separation Process Principles – S.W Seader & Henley
2. Chemical Engineering - Coulson – Richardson. (6^{th} Ed. Vol. II)
3. Mass Transfer - Treybal R.E. (3^{rd} Ed.)

SECOND SEMESTER BE-III

PROCESS EQUIPMENT DESIGN-I

Marks 100 + 50 **L-3, Tu-1,Tw-3**

1. Selection of Materials of Construction for Process equipments, and ancillary equipment.
2. Fabrication Methods for process equipment, Codes of construction for process Vessels.
3. Design of unfired process vessels subjects to internal pressure, design of end closures and heads, nozzles, flanges, Manholes etc.
4. Design of unfired pressure vessels under external pressure.
5. Design of non-pressure storage vessels, floating roofs, Design of Horton spheres.
6. Design of Tall vertical vessels.
7. Design of autoclaves and high-pressure vessels.
8. Pressure relief devices, Testing of pressure vessels.
9. Design of Agitators, Mixers, calculation of energy requirement and shaft diameters.
10. Design of supports.

GENERAL CHEMICAL TECHNOLOGY-II

Marks 100 + 50 **L-3, Tu-1,Pr-3**

1. Petroleum Production and refining.
2. Primary Petrochemicals: - C_1, C_2, C_3, C_4, compounds, Aromatics
3. Intermediate chemicals derived from C1, C2, C3, C4 compounds.
4. Chemicals from aromatics: - Dyestuffs.
5. Polymerization processes, Plastics and resins - Polyethylene, Polypropylene, Polyvinyl, Phenolformaldehyde, Synthetic rubbers - BR, SBR and other types Fibers - Rayon, Nylons, Decron, mylar, Polyacrylonitrile.
6. DDT, BHC, Malathion, Parathion, Pesticides, Pharmaceutical Industries.
7. Pollution and waste treatment, Explosive, Rocket propellants and other chemicals for space technology.
8. Biotechnology :- Introduction, Importance in synthesis of organic chemicals, SCP and fuels, Manufacture of alcohol and major pharmaceuticals, Enzymatic hydrolysis of cellulosic substances, Importance of immobilized cell technology in large-scale production of organic chemicals, planning, economics and technology transfer in chemical industry.

Books:-

1.. Chemical Process Industries by N.R..Shreve
2. Outline of Chemical Tech. by C. Dryden
3. Unit Processes of Organic Synthesis by P.Groggins.
4. Chemical Technology by Bhaskaran

MASS TRANSFER OPERATIONS II

Marks: 100 + 50 ***L-3, Tu-1, Pr-3***

Introduction to distillation. Vapour liquid equilibria, Techniques of Distillation Differential, Equilibrium(Flash), Fractionation etc.

Analysis of binary distillation: Lewis Sorel method of calculation, McCabe & Thiele Method for determining number of ideal plates, Ponchon & Savarit method for design of plate column. Concept of plate efficiencies. Distillation in packed columns.

Extraction Equilibria, Stagewise & Continuous contacting equipment. Multistage counter current extraction with or without reflux.

Leaching: Unsteady state & steady state operations.

Membrane Separation processes: Reverse Osmosis, Ultra filtration, Micro filtration, dialysis, pervaporation, concepts, analysis & design of membrane modules.

Books

1.Separation Process Principles – S.W Seader & Henley
2. Chemical Engineering - Coulson – Richardson. (6^{th} Ed. Vol. II)
3. Mass Transfer - Treybal (3^{rd} Ed.)

CHEMICAL REACTION ENGINEERING I

Marks 100 **L-3, Tu-1,**

(1). Introduction to Chemical Kinetics, Types of reactions, Formulation of rate equations for simple and complex reactions
(2). Analysis of simple and complex rate equations, Interpretation of rate data in constant and variable volume systems
(3). Concept of ideality, Development of design expression for batch, Tubular and stirred tank and semi-batch reactors
(4). Multiple reactor systems, Same and different types in series and parallel. Recycle reactor, Advantages and limitations in application, Introduction to process design for some industrial reactors
(5). RTD and non-ideal reactor analysis, One parameter models for non-ideal reactor RTD and their equivalence, Conversion calculations using RTD measurements. Use of RTD models for reactor performance evaluation.
(7). Equilibrium conversion, Heats of reaction and temperature, Optimum temperatures for isothermal and non-isothermal operations, Product distribution and effect of temperature in multiple (complex) reactions
(8). Evaluation of adiabatic and non-adiabatic reactor performance, Thermal stability or reactors

Books:

1. Chemical Reaction Engineering - Octave Levenspiel
2. Elements of Chemical Reaction Engineering – H.S.Fogler

MECHANICAL OPERATIONS

Marks: 100+50 **L-3, Tu-1, Pr-3**

1. Differential and cumulative sieve analysis, Laws of crushing.
2. Screening equipment, Screen effectiveness, Size enlargement.
3. Size reduction equipment: Selection and power requirements.
4. Agitation and mixing of liquids, Different types of impellers, Vortex, Power consumption for Newtonian and non-Newtonian fluids and slurries.
5. Mixing of solids and paste, Storage, Handling and conveying of solids.
6. Gravity settling and sedimentation: Principles, Applications and equipments.
7. Centrifugation, Separation of immiscible liquids, Suspensions and Gas mixtures.
8. Filtration:
   Principles and Calculations, Compressible cakes.
   Filtration equipment, Filter aids and filter media.
9. Fluidization: Velocity, Bed expansion, Pressure drop, Applications of fluidization.

Books:

1. Chemical Engineering by -Coulson – Richardson. (6^{th} Ed. Vol. II)
2. Unit Operations by – McCabe and Smith.

Practicals:

1. Sieve analysis
2. Roll crusher
3. Ball mill
4. Power consumption for agitation of liquid
5. Settling and sedimentation
6. Super centrifuge
7. Hydraulic thickner
8. Filter press
9. Centrifuge filter
10. Vacuum filtration
11. Fluidization characteristics