

CHEMICAL ENGINEERING

Engineering Mathematics : Determinants and matrices, system of linear equations, eigenvalues and eigenvectors.

Calculus : Mean value theorems of integral calculus, partial, total and directional derivatives, maxima and minima. Sequences and Series, convergence, Fourier series.

Vector calculus : Gradient, divergence and curl, line and surface integrals, Green, Gauss and Stokes theorems. Ordinary differential equations first order equations linear and nonlinear equations, higher order linear equations with constant coefficients, initial and boundary value problems, Laplace transforms.

Complex analysis : Complex number, polar form of complex number, Powers and roots, Limit derivative, analytical functions.

Probability and Statistics : Concept of probability, means and variance, linear regression analysis.

Process calculations and Thermodynamics : Laws of conservation of mass and energy ; use of tie components; recycle, bypass and purge calculations; degree of freedom. First and Second laws of thermodynamics and their applications ; equations of state and thermodynamic properties of real systems; phase equilibria; fugacity, excess properties and correlations of activity coefficients ; chemical reaction equilibria.

Fluid mechanics and mechanical operations : Fluid statics, Newtonian and non-Newtonian fluids, Macroscopic energy balance, Bernoulli equation, dimensional analysis, continuity equation, flow through pipeline systems, flow meters, pumps and compressors, packed and fluidized beds, elementary boundary layer theory, size reduction and size separation ; free and hindered settling ; centrifuges and cyclones; thickening and classification, filtration; mixing and agitation; conveying of solids.

Heat Transfer : Conduction, convection and radiation, heat transfer coefficients, steady and unsteady heat conduction, Boiling, condensation and evaporation types of heat exchangers and evaporations and their design.

Mass Transfer : Fick's law, mass transfer coefficients, Film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stage wise and continuous contacting and stage efficiencies; design and operation of equipment for distillation, absorption, leaching, liquid-liquid extraction, crystallization, drying, humidification, dehumidification and absorption.

Chemical Reaction Engineering : Theories of reaction rates; Kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, non-ideal reactors; non-isothermal reactors; kinetics of heterogeneous catalytic reactions; diffusional effects in catalysis.

Instrumentation and process control : Measurement of process variables; dynamics of simple systems such as CSTRs, heat exchangers etc.; transfer functions and responses of simple systems, process reaction curve, controller modes (P, PI and PID); control valves; analysis of closed loop systems including stability, frequency response (including Bode plots) and controller tuning.

Plant Design and Economics : Design of chemical engineering equipment ; principles of process economics and cost estimation.

Chemical Technology : Inorganic chemical industries ; sulfuric acid, NaOH, fertilizers ; natural products industries : (Pulp and paper, sugar, oil and fat) petroleum refining and petrochemicals polymerization industries : polyethylene, polypropylene and synthetic fibres.