

AMSE02 TRANSFER OPERATIONS IN CHEMICAL ENGINEERING

UNIT-1 IMPORTANCE OF HEAT TRANSFER IN CHEMICAL ENGINEERING OPERATIONS

- 1.1 Modes of heat transfer, Mean temperature difference.
- 1.2 Concept of heat conduction- Fourier's law of heat conduction, one dimensional steady state heat conduction equation for flat plate, hollow cylinder, and hollow sphere
- 1.3 Heat conduction through a series of resistances
- 1.4 Analogy between flow of heat and flow of electricity.
- 1.5 Individual and overall heat transfer coefficients and the relationship between them.
- 1.6 Concept of heat transfer by convection, Natural and forced convection
- 1.7 Application of dimensional analysis for convection, Equations for forced convection under laminar, transition and turbulent conditions
- 1.8 Equations for natural convection Heat transfer from condensing vapours, heat transfer to boiling liquids.

UNIT-2 HEAT EXCHANGERS:

- 2.1 Parallel and counter flow heat exchangers- Log mean temperature difference-
- 2.2 Single pass and multipass heat exchangers; plate heat exchangers; use of correction factor charts; heat exchangers effectiveness; number of transfer unit-
- 2.3 Chart for different configurations- Fouling factors and Wilson's plot- Design of various types of heat exchangers.
- 2.4 Radiation: Concept of thermal radiations- Black body concept- Laws of radiation- concept of grey body- radiation between surfaces.
- 2.5 Evaporation: Types of evaporation- single effect and multiple effect evaporation- Design calculation for single and multiple effect evaporation.

UNIT-3 PRINCIPLES OF MASS TRANSFER,

- 3.1 Fick's law of molecular diffusion, diffusion in solids and liquids.
- 3.2 Concept of mass transfer coefficients, mass transfer at fluids surfaces, correlation of mass transfer coefficients, theories of mass transfer and their applications,
- 3.3 Interphase mass transfer and over all mass transfer coefficients in binary systems.
- 3.4 Absorption, Equilibrium and operating line concept in absorption calculations; types of contactors, design of packed and plate type absorbers;
- 3.5 Operating characteristics of stage wise and differential contactors, concepts of NTU, HTU and overall volume mass transfer coefficients.

UNIT-4 DISTILLATION

- 4.1 Relative volatility, simple distillation, steam distillation, distillation with reflux, principle of azeotropic and extractive distillation.

- 4.2 McCabe Thiele method of calculation of number of theoretical stages, total, minimum and optimum reflux.
- 4.3 Introduction to drying-equilibrium moisture and free moisture, critical moisture content, bound and unbound water, rate of drying curves, drying equipment's-tray dryers, tower dryers, rotary dryers, fluid-bed dryers, spray dryers.
- 4.4 Principle of liquid-liquid extraction, liquid-liquid equilibrium, equipment for liquid extraction- mixer settlers, spray towers, Bollman extractor.
- 4.5 Solid- liquid extraction- simple leaching, major equipment's for solid -liquid extraction.

References Book:

1. Binay K. Dutta, Heat Transfer Principles and Applications, Prentice Hall of India, 2001.
2. Robert E. Treybal, Mass Transfer Operations, McGraw Hill.
3. W.L. McCabe, J.C.Smith & Peter Harriott, Unit Operations of Chemical Engineering, McGraw Hill Book Co,
4. W.L.Badger & J.T. Banchero, Introduction to Chemical Engineering, Tata McGraw-Hill

