

CH352: MASS TRANSFER – I

CREDITS = 6 (L = 4, T=0, P = 2)

1. **DIFFUSION:** Molecular and eddy diffusion, diffusion through solid, Mass transfer Coefficients and their correlation. Theories of Mass Transfer, theory of interphase mass transfer. 8 Hours
2. **EQUIPMENT FOR GAS LIQUID OPERATIONS:** Gas dispersed equipments like bubble column, Agitated vessels. Tray towers: Bubble cap and Sieve tray towers. Operating characteristics of tray towers, Tower diameter, and internals. Tray efficiency liquid dispersed systems – Venturi scrubber wetted wall columns, Spray columns. Packed tower: Types of Packing & Column internals. Flooding and loading, pressure drop, Mass transfer in packed column, Comparison between tray & packed tower 4 Hours
3. **GAS ABSORPTION & STRIPPING:** Outline of general Design Procedure selection of solvent, Equilibrium data, Selection of equipment, Determination of column diameter and pressure drop. Tray efficiencies in plate absorber & stripper. Packed Tower design – Calculation of H.T.U. & NTU, Use of HETP data. Plate tower Design – Graphical Design Procedure, Algebraic methods for the dilute and concentrated gases. Introduction to non-isothermal absorption & multicomponent absorption design & Mass Transfer with Chemical reaction. 10 Hours
4. **DISTILLATION:** Introduction – phase equilibrium data, VLE data, Flash distillation – isothermal & adiabatic, Simple distillation, Steam distillation, vacuum vs pressure distillation. Determination of no of equilibrium stages in Continuous Distillation
Enthalpy concentration diagram, Ponchen & Savarit method, McCabe thiele method., multiple feed. Introduction to multi – component distillation, extractive and azeotropic distillation. Batch Distillation: Simple batch distillation & batch distillation with reflux. Packed Columns for distillation, Flooding, Loading. NTU & HETP 12 Hours
5. **HUMIDIFICATION:** Psychometric chart and its applications; dew-point, adiabatic saturation temperature and wet-bulb temperature; design of pray chamber; design of humidifier and dehumidifier; cooling tower design consideration. 6 Hours

REFERENCE BOOKS

Title: Mass Transfer Operations
Author: R E Traybal
Publisher: Tata McGraw Hill

Title: Transport Processes & Unit Operations
Author: Geankopils C
Publisher: PHI

Title: Mass Transfer Opeations
Author: Binay K Dutta
Publisher: PHI

Title: Chemical Engineering Vol II
Author: Coulson & Richardson
Publisher: Asian Books Pvt. Ltd.

Title: Unit Operation in Chemical Engineering
Author: McCabe & Smith
Publisher: Tata McGraw Hill

LIST OF EXPERIMENTS

1. To determine the diffusivity of vapor in stagnant air.
2. To estimate the diffusivity coefficient (D_{AB}) of solute A (Acetic acid) into B (Water).
3. To determine the mass transfer coefficient (K_g) for the evaporation of liquid (Acetone) in air.
4. To determine the rate of evaporation of naphthalene from the surface and the mass transfer co-efficient of a given solid component in air.
5. To verify Rayleigh's equation for simple distillation.
6. To determine the vaporization efficiency of steam distillation.
7. To determine the height equivalent to theoretical plate (HETP) and the height of transfer unit (HTU) for a given packed column by carrying out distillation at total reflux. (Fractional Distillation)
8. To obtain the boiling point diagram for given binary system using OTHMER'S STILL
9. To study the performance and find out the mass transfer coefficient of the given cooling tower.
10. To study the loading and flooding characteristics in packed bed.
11. Experiment on Gas absorption.