

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: V

CHEMICAL ENGINEERING

Subject Name: **Mass Transfer Operation-I**

Subject Code: **150501**

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Internal Assessment (I)
3	0	3	6	70	30	50

Sr. No.	Course content
1.	Introduction to mass transfer operations.
2.	Molecular and Eddy Diffusion in fluids: Definition of molecular and eddy diffusivity, Ficks first law, Concept of N & J Flux, Steady state molecular diffusion in fluids at rest and in laminar flow, Diffusivity of gases, Diffusivity of liquids, Applications of molecular diffusion.
3.	Inter Phase Mass Transfer: Concept of overall mass transfer coefficient, Concept of effective diffusivity. Film penetration and surface renewal theory.
4.	Gas Absorption: Solubility of gases in liquids, Ideal and non-ideal solution, Choice of solvent for absorption, Material balance and liquid gas ratio for absorption and stripping, Counter current multi stage operation (isothermal), Continuous contact equipments, Introduction to absorption with chemical reaction, Multi component absorption and non isothermal absorption, Concept of HETP and HTU, NTU and jh factor, Industrial absorbers.
5.	Equipments for Gas Liquid Operations: Sparged vessels, Agitated vessels, Venturi scrubber, Spray tower, Tray Towers: Tray tower internals, Different types of trays, Weirs, Downcomers and criteria of their selection, Flooding, Loading, Coning, Weeping & dumping in tray tower, Packed Towers: Packed tower internals, Different types of packings and their selection criteria, Different types of liquid distributors, Redistributors, Packing supports, Mist eliminators and packing restrainers and their selection criteria, Flooding, Loading and channeling in packed tower, Tray tower vs. Packed tower.

6.	Liquid-Liquid Extraction and Leaching: Ternary liquid- liquid equilibrium and tie line data choice of solvent, Single stage & multistage extraction, Co-current and cross current extraction, Continuous counter current multistage extraction with and without reflux, Theory & performance of continuous contact equipments, Single stage & multistage equipments, Applications of liquid-liquid extraction, Steady state and unsteady state leaching equipments, Single stage leaching, Multistage cross current and counter current leaching, Rate of leaching, Recovery of solvent vapors, Application of leaching.
7.	Crystallization: Saturation, Nucleation, Crystallization rate, Effect of temperature on solubility, Caking of crystals, Batch crystallizers, Continuous crystallizer.

Practical and Term Work:

Experiments based on the above topics.

Reference Books:

1. "Mass transfer operation" by R.E.Treybal, Mc-Graw Hill international.
2. "Mass Transfer" by Sherwood, Pigford & Wilke, Mc-Graw Hill international.
3. "Chemical Engineering", Volume-2, 4th edition by Coulson & Richardson.
4. Perry's Chemical Engineers handbook, 7th edition by Perry & Green, Mc-Graw. Hill international.
5. Unit Operations of Chemical Engg. By W.L. McCabe, J. C. Smith & Harriott, 6th edition Mc-Graw Hill international.