

Mass Transfer Operations-1

- 1.1 Course Number: CH274
- 1.2 Contact Hours: 3-1-2 Credits: 13
- 1.3 Semester-offered: 3rd Year-Odd
- 1.4 Prerequisite: Fluid Mechanics, Mass Energy Balance, Chemical Engineering Thermodynamics
- 1.5 Syllabus Committee Member: Dr G K Agrahari, Dr M. Kumar

2. **Objective:** The objective of the course is to provide basic knowledge of mass transfer principles and to develop skills for designing of some of basic mass transfer equipment. This is a core course.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topics	Lectures
1	Introduction to Mass Transfer Operations	Steady state molecular diffusion in fluids, Multicomponent diffusion, Diffusivity in solids and applications, Diffusion of gases in porous solids and capillaries, Unsteady state diffusion	5
2	Mass Transfer Coefficients	Individual and overall mass transfer coefficients; analogy and correlations, theories of mass transfer	7
3	Absorption and Stripping	Counter-current multi-stage absorption, operating line, number of equilibrium stages, tray design, pressure drop calculations, tray efficiency. Design of packed tower: NTU, HTU, Loading/flooding criterion	10
4	Distillation	Flash distillation, columns and their process calculations, binary distillation in trayed towers: McCabe-Thiele method, open-steam distillation, Ponchon-Savarit Method, multicomponent distillation (basic)	10
5	Extraction	Liquid-liquid equilibria, design of single-stage extraction, type and design of equipment, cross-current extraction, continuous countercurrent multistage extraction	8
6	Laboratory Classes	There will be 10-12 experiment designed based on the theory covered in the lectures to provide hand-on experience and in-depth understanding of the mass transfer processes.	2 hours/ week
Total			Lecture: 40 Practical: 20-24

4. Readings

4.1 Text Books:

1. Treybal, R.E., "Mass-Transfer Operations", 3rd Edition, McGraw-Hill (1981)
2. Dutta, B. K., "Principles of Mass transfer and Separation Processes," Prentice-Hall of India, New Delhi (2007).
3. Seader, J.D. and Henley, E.J., Separation Process Principles, Wiley, New York (1998)

4.2 Reference Books:

1. Hines, A. L.; Maddox, R. N., Mass Transfer: Fundamentals and Applications, Prentice Hall; 1 Edition (1984).
2. McCabe, W. L. and Smith, J. C., Unit Operations of Chemical Engineering, (3rd ed.), McGraw-Hill (1976).
3. Geankoplis, C.J. "Transport Processes and Separation Process Principles". 4th Edition, Prentice-Hall of India, New Delhi (2005)

5. **Outcome of the Course:** The course will help students to understand the fundamental aspects of mass transfer in a single phase, or across a phase boundary. Students will get exposure to some basic mass transfer operations and equipment used in process industries and their design.