Mass Transfer Operations-03

1.1 Course Number: CH376

1.2 Contact Hours: 2-0-0 Credits: 6

1.3 Semester-offered: 3rd Year- even

1.4 Prerequisite: Mass Transfer Operations-01

1.5 Syllabus Committee Member: Dr.V.S.Sistla, Dr Rakesh Kumar

2. **Objective:** the objective of the course is to provide knowledge regarding novel mass transfer techniques and to develop designing skills of multicomponent distillation and other complex distillation techniques. This is a core course.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Crystallization	Theory of crystallization, Types of crystal geometry, Solid-liquid phase equilibrium, Design of crystallization equipment, crystallization theory, particle size distribution and measurement	7
2	Membrane Separation	Gas permeation: binary mixture, multicomponent, effect of holes in membrane. Reverse osmosis: analysis of osmosis and reverse osmosis, RO membrane principles, concentration polarization. Microfiltration, Ultrafiltration, Pervaporation: basics and design, Bulk flow pattern effects, Dialysis: process, equipment, design	7
3	Multicomponent Separation	Multicomponent distillation, equilibrium data, boiling and dew point, and flash distillation, key components, total reflux, shortcut method (Fenske-Underwood-Gilliland), stage-wise calculation procedure (simultaneous heat balance and component balance, trigonal matrix algorithm, bubble-point method, sum-rate method, Newton-Raphson method, Naphtali-Sandholm convergence method)	9
4	Complex distillation methods	Azeotropic (homogeneous and heterogeneous) distillation, Steam distillation, pressure-swing distillation, Complex ternary distillation systems, extractive distillation	5
		Total	**28**

4. **Readings**

4.1 Textbook:

1. Geankoplis, C.J.,“Transport Processes and Separation Process Principles”. 4th Edition, Prentice-Hall of India, New Delhi (2005)
2. Separations in Chemical Engineering: Equilibrium Staged Separations: P. C. Wankat, Prentice Hall, NJ, US, 1988
3. Seader, J.D. and Henley,E.J.,Separation Process Principles, Wiley, New York (1998)

4.2 Reference books:

1. Treybal, R.E.,“ Mass-Transfer Operations”, 3rd Eddition, McGraw-Hill (1981)
2. Dutta,B.K.,“Principles of Mass transfer and Separation Processes”.Prentice-Hall of India, New Delhi (2007).
3. C. Judson King, Separation Processes, Second Edition, Dover Publicationns, Inc, New York, 2013.

5. **Outcome of the Course:** The course will help students to understand separation using crystallization and membrane. Students will develop designing skills for multicomponent distillation and other complex distillation techniques, pertinent to refineries.