

## UCH502: MASS TRANSFER-I

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>3.5</b>

### Course Objectives:

To impart the knowledge of mass transfer operations and equipment.

**Introduction:** Overview of separation processes.

**Diffusion:** Steady state molecular diffusion in gases and liquids, Fick's first Law of diffusion, Fick's second Law of diffusion, Correlation for diffusivity in gases and liquids for binary and multi-component systems, Diffusivity measurement and prediction, Diffusion in solids, Types of solid diffusion.

**Mass Transfer Coefficients:** Concept of mass transfer coefficients, Mass transfer coefficients in laminar flow and turbulent flow, Mass, heat and momentum transfer analogy, etc, Simultaneous heat and mass transfer.

**Interphase Mass Transfer:** Equilibrium curve, Diffusion between phases, Overall mass transfer coefficient, Two film theory in mass transfer, Steady state concurrent and counter current Process, Stages and Multistage cascade, Kremser equation for dilute gas mixtures.

**Mass transfer equipment:** Gas dispersed: bubble column, Mechanically agitated vessels, Mechanical agitation of single phase liquid, Mechanical agitation of gas liquid contact, Venturi scrubber, Wetted Wall tower, Spray tower, Tray tower, Packed tower, Classification of packing materials, Cooling tower.

**Gas Absorption:** Equilibrium solubility of gases in liquids, isothermal and adiabatic gas-liquid contact, Choice of solvents, Material balance in absorber, Counter-current multistage operations, Continuous contact equipment, Design of absorption towers, Gas absorption with chemical reaction.

**Crystallization:** Solid liquid phase equilibrium, Nucleation and crystal growth, Batch crystallization, crystallization equipment.

**Drying:** Drying Equilibria, The drying rate curve, calculations of the drying time from drying rate data, Classification of the drying equipment, Dryer selection, Different type of dryer.

### Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. solve problems related to diffusion and interphase mass transfer and mass transfer equipments
2. perform design calculation related to absorption and humidification.
3. solve problems related to drying and crystallization

### Text Books:

1. Treybal, R.E., *Mass Transfer Operations*, McGraw Hill (1980) 3<sup>rd</sup> Ed.

2. McCabe, W.L., and Smith, J.C., *Unit Operations of Chemical Engineering*, McGraw Hill, 3<sup>rd</sup> Ed. (1993).

**Reference Books:**

1. Sherwood, T.K, Pigford, R.L., and Wilkes, C.R, *Mass Transfer*, McGraw Hill (1975).
2. Geankoplis, *Transport Processes and Unit Operations*, Prentice-Hall of India (1993) 4<sup>th</sup> Ed.
3. Seader, H., Henley, J. E., *Seperation Process Principles*, Wiley India (2007) 2<sup>nd</sup> Ed.
4. Skelland, A.H.P., *Diffusional Mass Transfer*, John Wiley & Sons (1985).

**Evaluation Scheme:**

S. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessional (May includes tutorials/ assignments/ quiz's etc)	25