


THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Mass Transfer-I

Course Overview



DEPARTMENT OF CHEMICAL ENGINEERING
Thapar Institute of Engineering & Technology
Patiala (Punjab), INDIA-147004

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Associate Professor

UCH502:Mass Transfer-I (Course Overview)

Dr. Avinash Chandra

Course objectives

To impart the knowledge of mass transfer operations and equipment

- To develop an understanding of mass transfer fundamental/concepts/principles
- To provide a theoretical and analytical background for mass transfer analysis
- To tackle onsite engineering problems ranging from simple to complex

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Course modules

- 1 Introduction
- 2 Diffusion
- 3 Mass Transfer Coefficients
- 4 Interphase Mass Transfer
- 5 Mass transfer equipment
- 6 Gas Absorption
- 7 Crystallization
- 8 Drying
- 9 Pressure vessels design

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UCH502: MASS TRANSFER-I

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1 Introduction

Introduction: Overview of separation processes.

2 Diffusion

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.

3 Mass Transfer Coefficients

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.

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4 Interphase 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.

5 Mass transfer equipment

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.

6 Gas Absorption

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. Packed towers and column internals, Types of packing, general pressure drop correlation, Column diameter and height.

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7 Crystallization

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

8 Drying

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

9 Pressure vessels design

Pressure vessels design: Design pressure, Design temperature, Design stress, Factor of safety, Design wall thickness, Corrosion allowance, Weld joint efficiency factor, thin & thick wall cylindrical and spherical vessels, Tall vessels, Storage vessels.

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Text Books

- Treybal, R.E., Mass Transfer Operations, McGraw Hill 3rd Ed (1980)
- McCabe, W.L., and Smith, J.C., Unit Operations of Chemical Engineering, McGraw Hill, 3rd Ed. (1993)
- Bhattacharyya, B.C., Introduction to Chemical Equipment Design, Mechanical Aspects, CBS Publishers and Distributors (2009)

Reference Books

- Sherwood, T.K, Pigford, R.L., and Wilkes, C.R, Mass Transfer, McGraw Hill (1975)
- Geankoplis, Transport Processes and Unit Operations, P-Hall of India 4th Ed. (1993)
- Seader, H., Henley, J. E., Separation Process Principles, Wiley India 2nd Ed. (2007)
- Skelland, A.H.P., Diffusional Mass Transfer, John Wiley & Sons (1985)
- Mahajani, V.V. and Umarji, S.B., Joshi's Process Equipment Design, 4th edition, Macmillan Publishers India Limited, New Delhi (2010)

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Evaluation Scheme

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

References



ETH
 Theories for Mass Transfer Coefficients
 Lecture 9, 15.11.2017, Dr. K. Wegner

- Lecture notes/ppt of Dr. Yahya Banat (ybanat@qu.edu.qa)