

INSTITUTE	FACULTY OF TECHNOLOGY
PROGRAM	MASTER OF TECHNOLOGY in CHEMICAL ENGINEERING
SEMESTER	1
COURSE TITLE	ADVANCED MASS TRANSFER
COURSE CODE	01CM2103
COURSE CREDITS	3

Objective:

- 1 To apply the basics of mass transfer to build the allied mechanisms and operations those are essential for process industries.

Course Outcomes: After completion of this course, student will be able to:

- 1 Understand the phenomenon of mass transfer in various operations using advanced techniques.
- 2 Analyze the mass transfer operation
- 3 Select suitable mass transfer operation for particular separation process
- 4 Determine the use and implication of distillation process with suitable number of stages and desired type
- 5 Determine number of stages and height of packed column in distillation and extraction operation

Pre-requisite of course: Basics of fluid flow physics, Mathematics & Mass transfer

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	Introduction Flux Definition, Differential Equations of Mass transfer, Molecular diffusion, Mass Transfer coefficients, Methods of operation and equipment, unsteady state and steady state operation.	8
2	Distillation Introduction, Vapor liquid equilibrium, methods of distillation two component mixtures, The fractionating column, Conditions for varying overflow in non-ideal binary systems, Batch Distillation, Multicomponent Mixtures, Azeotropic and Extractive distillation, Steam Distillation, Plate columns, Packed column for Distillation, Multicomponent distillation: Bubble point and dew point calculations, Molecular distillation, Reactive distillation	10

Contents : Unit	Topics	Contact Hours
3	Absorption & Equipments for Gas-Liquid Operations Gas Absorption - Equilibrium solubilities of gases. Material balance for transfer of one component, Counter current multistage operations for binary and multi component systems. Continuous contactors, absorption with chemical reaction, Concept of HTU and NTU. Mass transfer coefficients for packed towers concurrent flow of gas and liquid end effect and axial mixing	10
4	Extractive fractional distillation Introduction, Extraction Processes, Equilibrium data, Determination of number of theoretical stages. Methods for prediction, mechanism of relative volatility change, choice of entrainer or solvent, design of an azeotropic distillation process, design of an extractive distillation process, methods of solvent recovery	8
5	Adsorption Theories of adsorption, Adsorption Isotherms and ion exchange processes: Various isotherms. Contact filtration, design of fixed bed adsorber including breakthrough curve. Application of the Freundlich equation, Industrial adsorbents, Equilibrium adsorption of vapours, Equipment of adsorption, Rotating fixed bed adsorption, Batch & continuous multistage Adsorption	8
Total Hours		44

Textbook :

- 1 Mass-transfer operations, Treybal, R. E. , McGraw Hill Education, 2017
- 2 Mass transfer-ii. , Gavhane, K. A. , Nirali Prakashan, 2015

References:

- 1 Unit operations of chemical engineering, Unit operations of chemical engineering, McCabe, W. L., Smith, J. C., & Harriott, P., McGraw-hill., 1993
- 2 Chemical Engineering, Volume 2: Particle Technology and Separation Processes, Chemical Engineering, Volume 2: Particle Technology and Separation Processes, J.M. Coulson and J.F. Richardson., Pergamon Press, Oxford., 1991
- 3 Principles of mass transfer and separation processes, Principles of mass transfer and separation processes, Dutta, B. K. , PHI Learning Pvt. Ltd., 2007

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	20.00	25.00	25.00	10.00	10.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by white board, may also use any of tools such as collaborative learning, demonstration, role play, Quiz, brainstorming, MOOCs, Active Learning Assignments etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Supplementary Resources:

- 1 <https://nptel.ac.in/courses/103/104/103104046>
- 2 <https://nptel.ac.in/courses/103/103/103103154>
- 3 <https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ch31>