

INSTITUTE	DIPLOMA STUDIES
PROGRAM	DIPLOMA ENGINEERING (CHEMICAL ENGINEERING)
SEMESTER	5
COURSE TITLE	UNIT OPERATION - IV
COURSE CODE	09CH2501
COURSE CREDITS	5

Objective:

- 1 To introduce the basic fundamentals of several Mass Transfer operations carried out in the industry

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

- 1 Classify various Mass Transfer operations being carried out in the industry
- 2 Appreciate the importance of various M.T. operations
- 3 Predict the kind of M.T. operation required for a particular separation

Pre-requisite of course: MTO-I, Stoichiometry, Fluid flow, Heat Transfer.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	4	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Equipments for Gas-Liquid Operations Tray Towers, Different types of Trays, weirs, criteria for selection of trays, Flooding, Loading in Tray Tower, spray Towers, Packed Towers, different types of Packings, Venturi Scrubber	6
2	Adsorption Definition and Industrial application, Types of Adsorption, various equipments for adsorption, commonly used Adsorbents in Chemical Industries, Effect of Temperature on Adsorption, Hysteresis, Freundlich Equation.	6
3	Humidification Importance of Humidification operation in Chemical Industry, Definitions: Absolute Humidity, Relative Humidity, % Humidity, Wet Bulb, Dry Bulb, Dew Point, Humid Heat, Humid Volume, Psychrometric Chart, Cooling Towers: Natural Cooling Tower, Forced Cooling Tower.	6

Contents : Unit	Topics	Contact Hours
4	Crystallization Concept and application, methods for super saturation, classification of crystallizer, Meir's theory, concept of nucleation and crystal growth, effect of seeding and simple calculations for percentage yield, construction and working of Swenson Walker, tank, DTB, Krystal and Vacuum crystallizes.	6
5	Drying Importance of Drying in processes, principles of drying, equilibrium and free moisture, bound and unbound water, Classification of dryers, solids handling in dryers, equipments for batch and continuous drying processes: working principle of tray driers, tower driers, rotary driers, spray driers. Concept of Freeze drying	8
6	Distillation Introduction & Definition, Types of Industries using Distillation, Significance and uses of Distillation process in industries; Types of Distillation: Batch, Continuous, Flash, Rectification, Steam, Azeotropic. Vapour-Liquid Equilibrium, Raoult's Law, Volatility & Relative Volatility (α), Reflux operation in column & its significance, Reflux Ratio: Minimum, Optimum, and Infinite, Determination of number of stages by McCabe-Thiele method, Introduction of Feed and Location of the feed tray Physical aspects of Column: Partial & Total Reboiler, Partial & total Condenser, Plates, Feed Valve. Types of Plates used in Column.	10
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment 1 Carry out simple distillation in glass assembly	8
2	Experiment 2 To perform separation of Benzene-Toluene mixture using Batch Distillation	4
3	Experiment 3 To study and verify Freundlich Adsorption Isotherm adsorbing Oxalic Acid over Charcoal	8
4	Experiment 4 To study & perform Crystallization operation using Batch Crystallizer and to calculate the crystal yield.	8
5	Experiment 5 To Study the construction and working of Tray Dryer	4
6	Experiment 6 To study Working and construction of Rotary Dryer.	4
7	Experiment 7 To study Working and construction of spray dryer	4

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
8	Experiment 8 To study Working and construction of Tray tower.	4
9	Experiment 9 To study Working and construction of packed tower	8
10	Experiment 10 To study Working and construction of venturi scrubber	4
Total Hours		56

Textbook :

- 1 Mass transfer operation, R.E.Treybal, Mc-Graw Hill international, 2017
- 2 Mass Transfer- II , K.A. Gavhane, Nirali Prakashan, 2015

References:

- 1 Unit operations in chemical engineering , Unit operations in chemical engineering , McCabe & Smith, Mc-Graw Hill international, 2006
- 2 Introduction to chemical engineering, Introduction to chemical engineering, Badger &Banchero, John Wiley, 1994
- 3 Chemical engineering vol. 2 , Chemical engineering vol. 2 , Coulson & Richardson, Elsevier, 2012
- 4 Unit Operations of Chemical Engineering, Volume- IP, Unit Operations of Chemical Engineering, Volume- IP, P. Chattopadhyay, Khanna Publishers, 1995

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
40.00	40.00	10.00	10.00	0.00	0.00

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 black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs 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
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

- 1 <https://archive.nptel.ac.in/courses/103/103/103103154/>