

Subject Code: 01CH1604
Subject Name: Unit Operations in Chemical Engineering
B.Tech Year – 3 (Semester 6)

Objective: To understand various unit level operations carried out in a Chemical Process Industry

Credits Earned: 4 Credits

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

1. Understand the operations pertaining to Fluid Flow, Heat exchange, Mass Transfer.
2. Understand the various equipments used to carry out various operations.
3. Understand the basic governing fundamentals driving the processes in the industries.

Pre-requisite of course: Basic concepts of Physics, Chemistry & Mathematics.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (I)	CSE (C)	Viva (V)	Term work (TW)	
3	0	2	4	50	30	20	25	25	150

Contents:

Unit	Topics	Contact Hours
1	Introduction to Fundamentals of Unit Operations Definition & types of Unit operations and Unit Process, Fundamentals and Analogy between fluid flow operation, Heat Transfer operation, Mass transfer operation, Mechanical Operation	4
2	Fluid Flow Operations Types of fluids and their behaviour, Continuity equation, Bernoulli's equation and their application, Industrial Piping, Classification and types of Pumps, Flow meters & valves	10
3	Heat Transfer Operations Mode of heat transfer, Definition of conduction, Convection & radiation, Condensation & boiling, Fourier's law, Newton's law of cooling, Stephen Boltzmann law of radiation and their application Shell & tube heat exchanger & Evaporators.	12
4	Mass Transfer Operations Introduction of mass transfer operations like distillation, Extraction, absorption, Drying, Humidification, Crystallization, Types of diffusion and Fick's law of diffusion, Mass transfer coefficient, Film theory of mass transfer, Mass transfer equipments like cooling towers, Tray drier and distillation column.	12
5	Mechanical Operation Size reduction equipments, size separation equipments, introduction to filtration and Industrial Filters, Centrifuges, Cyclones, Thickeners, Sedimentation.	
	Total Hours	46

References:

1. "Unit Operations of Chemical Engineering", McCabe W L, Smith J C, Harriott P, McGraw Hill Publication, 7th edition 2005.
2. "Chemical Engineering" Vol. I – Fluid flow, Heat Transfer and Mass Transfer; Coulson & Richardson's, Butterworth – Heinemann Publication, 6th Edition.
3. "Heat Transfer Operations", Binay K. Dutta, PHI Publications, 2nd Edition.
4. "Mass Transfer & Separation Processes", Binay K Dutta, PHI Publications, 2nd Edition

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	Understand	Apply	Analyze	Evaluate	Create
30%	30%	20%	15%	5%	-

List of Experiments:

1. To study and verify Bernoulli's Theorem.
2. To calibrate venturimeter and obtain it's coefficient of Discharge.
3. To calibrate Orifice meter and obtain it's coefficient of Discharge.
4. To Determine The Thermal Conductivity Of The Given Composite Walls.
5. Determine Stephan Boltzman Constant Experimentally.
6. To find out the time required and efficiency of Tray Drier.
7. To find out the percentage recovery of distillate with steam distillation.
8. To Find out the efficiency of Jaw Crusher.
9. To Find out the efficiency of Roll Grinder.
10. To find out the critical speed of Ball Mill.
11. To Study the shell and tube Heat Exchanger.

Instructional Method:

- a. 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.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory