

Diploma Branches in which this subject is offered: Chemical Engineering

Objective: To study about Mechanical Operations generally carried out in Chemical Processes Industries involving solid-solid and solid-liquid handling, mixing and separation.

Credits Earned: 4 Credits

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

1. Understand different properties of particulate solids and methods of out its analysis.
2. Express criteria for selection of specific size reduction equipments based on their application.
3. Be able to utilize theoretical knowledge for fundamental design of suitable solid liquid separation operation
4. To build a bridge between theoretical and practical concepts of unit operation used in chemical industry to solve environmental pollution problems.

Pre-requisite of course: Basic concepts of units and dimensions, mass fraction mole fraction, material balance.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	Mid Sem	Internal	Practical Exam	Term work	
2	0	4	4	70	20	10	25	25	150

Contents:

Unit	Topics	Contact Hours
1	Particulate Solids: Introduction, Particle characterization, Concept of sphericity, Mixed particles size, specific surface area and specific number of particles Basic terms in screening, Screen analysis- differential and cumulative analysis.	04
2	Size Reduction and Screening Introduction, Crushing Law, Classification of size reduction equipments, Crushers, Grinders, Ultra-fine grinders, Cutting machines, Open circuit and closed circuit operation, Screen effectiveness, Ideal screen and actual screen, Different screening equipments.	06
3	Filtration, Sedimentation and Centrifugal Separation Definition and Mechanisms of filtration, Filtration theory, Filter media and filter aids, Classification & Selection of filtration equipments, Bag filter in air pollution control, Plate and frame filter press, Rotary drum filter etc. Batch sedimentation test, Applications of sedimentation, Theory of centrifugal separation, centrifugal filtration, Classification of centrifuges, Simple bowl centrifuge, Disc centrifuge, Tubular-bowl centrifuge, Gas centrifuge.	10
4	Solid-Solid and Solid-Fluid Separation Introduction, Magnetic Separation, Froth Floatation, Cyclone Separation and Electrostatic Precipitation.	08
	Total Hours	28

References:

- **Text Book:**

1. Unit Operations of Chemical Engg. by W.L. McCabe, J. C. Smith & Harriott, 6th Edition distribution co.

- **Reference Book:**

1. Chemical Engineering Volume-2, by J. F. Richardson, J. H. Harker and J. R. Backhurst, 4th edition, Butterworth-Heinemann International
2. Introduction to Chemical Engineering by W. L. Badger & J.T. Banchemo
3. Principles Of Unit Operations, 2nd Edition, By Alan S. Foust, Leonard A. Wenzel, Curtis W. Wiley-India Publishers.
4. Perry's Chemical Engineers handbook, 7th edition by Perry & Green, McGraw Hill International.

Chemical Engineering**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
20%	40%	20%	20%	-	-

List of Experiments: Any Five experiments to be performed

1. To study the construction and working also find out its efficiency of Jaw crusher.
2. To study the construction and working also find out its efficiency of Roll crusher.
3. To find out critical speed and efficiency of Ball Mill.
4. To separate heavy particles from solid-solid mixture using cyclone Separator.
5. To separate solid particles with the help of froth flotation unit.
6. To separate out solid from slurry with the help of press Filter.
7. To study Construction and working of centrifugal filtration.
8. To study Construction and working of vacuum filtration.
9. To Perform Batch Sedimentation to separate out un-dissolved solid from solid water solution.
10. To find out the screen effectiveness of Sieve Shaker.

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