

UCH401 FLUID AND PARTICLE MECHANICS

L	T	P	Cr
3	1	2	4.5

Course Objective:

To understand basic principles of various mechanical operations, construction and working of the equipments.

Characterization of Solid Particles: Determination of mean particle size, Particle shape and size distribution.

Screening: Types of screens, Screen effectiveness, Particle size analysis using screens.

Size Reduction: Principles of crushing and grinding, Laws of size reduction, Industrial size reduction equipment, Closed and open circuit grinding.

Fluid-Solid Separations: Stoke's law, Free and hindered settling, Clarification and thickening, Elutriation, Zigs, Froth flotation, Centrifugal separation.

Flow Past Immersed Bodies: Friction in flow through packed beds, Motion of particles through fluids.

Fluidization: Mechanism of fluidization, Determination of minimum fluidization velocity, Determination of velocity range for the operation of a fluidized bed, Types and applications of fluidization.

Filtration: Theory of filtration and filtration equipment.

Handling of Solids: Storage of solids, Sizing of hoppers and bins, Conveying systems: Mechanical, pneumatic and hydraulic, Mixing of solids and liquids.

Laboratory Work:

Screen analysis, Power requirement in mixing, Plate and frame filter press, Leaf filter, Elutriation, Pressure drop in fluidized bed and packed bed, Sedimentation, Centrifugal pump characteristics, Size reduction, Cyclone separator.

Course Learning Outcomes (CLO)

The students will be able to:

1. solve and analyze problems of size reduction and solid-solid separation methods.
2. analyze and design of equipment handling fluid-particle systems.
3. analyze mixing process, and sizing of hoppers and bins and selection of suitable solid conveying systems.
4. analyze and solve problems related to flow through beds of solids.

Text Books:

1. McCabe, W.L., Smith, J.C., and Harriot, P., *Unit Operations of Chemical Engineering*, McGraw-Hill (2005).
2. Richardson, J.F., Harker, J.H. and Backhurst, J.R., *Coulson and Richardsons Chemical Engineering, Vol. 2*, Butterworth-Heinemann (2007).

Reference Books:

1. Foust, A.S, Wenzel, L.A, Clump, C.W., Maus, L. and Anderson, L.B., *Principles of Unit Operations*, John Wiley (2008).
2. Perry, R.H, and Green, D.W., *Perry's Chemical Engineers' Handbook*, McGraw Hill (2007).
3. Narayanan, C.M. and Bhattacharya, B.C., *Mechanical Operations for Chemical Engineers Incorporating Computer Aided Analysis*, Khanna Publishers (2005).

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (may include lab/tutorials/ assignments/ quizzes)	40