

UCH401 FLUID AND PARTICLE MECHANICS (WITH PROJECT)

L	T	P	Cr
3	1	2	8.0

Course Objective:

To understand basic principles of fluid and particle mechanics including construction and working of the equipments.

Particle Characterization and Handling: Determination of mean particle size, Particle shape and size distribution, Screen analysis, Storage of solids, conveying systems

Size Reduction: Laws of size reduction, Industrial size reduction equipment.

Fluid-Solid Separations: Free and hindered settling, Clarification and thickening, Froth flotation, Centrifugal separation, Theory of filtration and filtration equipment

Packed and Fluidized Bed: Friction in flow through packed beds, Mechanism of fluidization, Determination of minimum fluidization velocity, Determination of velocity range for the operation of a fluidized bed.

Agitation and Mixing of Liquids: Types of impellers, Power consumption, mixing times, Scale up.

Pumps and Compressors: Types, Working principles, Basic equations, NPSH, Cavitation, Priming.

Flow of Compressible Fluids: Basic equations: Adiabatic, isothermal and isentropic flows.

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)

Upon completion of this course, 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.

5. solve the problems related to compressible fluids, and fluid machinery.

Projects based on:

- Pumps characteristics
- Solid-solid separations
- Solid-liquid separations
- Solid-gas separations
- Flow through packed and fluidized beds

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	20
2	EST	30
3	Sessional (May include may be tutorials/ quiz's/ /lab/ project)	50