

PCH333 SELECTED TOPICS IN FLUID MECHANICS

L	T	P	Cr
3	1	0	3.5

Course Objective:

To learn the basics and advanced concepts of fluids and fluid flow including flow of compressible fluids, laminar and turbulent boundary layer flows and multiphase flow.

Introduction: Basic fluid flow concepts, Velocity and stress fields, Classification of fluids, Fluid kinematics, Navier-Stokes Equation, Energy equation (Bernoulli), Pipe flows, Pumps and compressors.

Flow of Compressible Fluids: Basic Equations and assumptions, Isentropic flow through nozzles, Adiabatic friction flow, Isothermal friction flow, Sonic and Sub-sonic flows

Boundary Layer: Laminar and turbulent boundary layer flows, Boundary layer parameters, Prandtl's boundary layer equations, Blasius solution, von-Karman momentum integral equation, Boundary layer separation.

Flow Pattern: Flow pattern of gas-liquid and liquid- liquid concurrent flow in horizontal and vertical tubes.

Pressure Drop and Hold-up: Holdup relations for various multiphase flow regimes, Friction factor models and Correlations of Lohhart-Martinelli and Hughmark, Evaporating and condensing one component flow, Equations of change with interphase transport.

Drops and Bubble Dynamics: Formation of drops and bubbles, Motion of single drops and bubbles, Effect of circulations and interaction for drops and bubbles.

Course learning outcomes (CLOs):

The students will be able to

1. estimate boundary layer parameters for different flows
2. apply the compressible flow equations
3. perform dynamics of pressure drop and hold-up
4. perform dynamics of drops and bubbles quantitatively

Recommended Books:

1. McCabe, W., Smith, J., and Harriot, P., *Unit Operations of Chemical Engineering*, McGraw-Hill (2005).
2. Perry, R.H. and Green, D.W., *Perry's Chemical Engineer's Handbook*, McGraw-Hill (1997).
3. Foust, A.S., Wenzel, L.A., and Clump, C.W., *Principles of Unit Operations*, Wiley & Sons (1980).
4. Walls, G.B., *One Dimensional Two-phase Flow*, McGraw-Hill (1969).
5. Govier, G.W., and Aziz, K., *Flow of Complex Mixture in Pipes*, Van Norstand Reinhold Co. (1972).

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessional (may include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25