CH124	FLUID AND PARTICLE MECHANICS	L	T	P	C	Int	Ext
		3	-	-	3.0	30	70

Semester II [First Year]

COURSE OBJECTIVES:

1. To introduce basis and models for fluids
2. To provide basis for formulating conservative principles.
3. To provide an understanding about compressible fluids and flow past immersed bodies.
4. To study methods for transporting and measuring of flow in various conduits.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Solve problems related to manometers and decanters using the principles of fluid statics and apply dimensional analysis.
2. Determine the pipe size / flow rate / power requirements under laminar and turbulent flow conditions from material and energy balances.
3. Solve problems involving motion of particles in fluid, fluidÃ¢â‚¬â€œsolid operations in packed beds and fluidized beds
4. Select appropriate fluid moving machinery and valves for a given flow problem and Estimate flow rate using head and area meters such as Venturi meter, Orifice meter and Pitot tube.

UNIT I [CO:1] **(15)**

Introduction: Unit operations, unit systems, dimensional analysis, basic concepts. Fluid statics and its applications-hydrostatic equilibrium, applications of fluid statics- manometers and decanters.

Fluid Flow Phenomena: Laminar flow, Shear rate, Shear stress, Rheological properties of fluids, Turbulence, flow in boundary layers, its formation and growth in tubes and on plates.

UNIT II [CO:2] **(15)**

Basic Equations of Fluid Flow: Mass balance in a flowing fluid; Continuity, differential momentum balance; equations of motion, macroscopic momentum balances, Mechanical energy equations.

Incompressible Flow in Pipes and Channels: shear stress and skin friction in pipes, laminar flow in pipes and channels, turbulent flow in pipes and channels, friction from changes in velocity or direction.

UNIT III [CO:3] **(15)**

Flow past immersed bodies: Drag and drag coefficient, flow through bed of solids, motion of particles through fluids, fluidization and applications of fluidization. 1) Solve problems related to manometers and decanters using the principles of fluid statics and apply dimensional analysis. 2) Determine the pipe size / flow rate / power requirements under laminar and turbulent flow conditions from material and energy balances. 3) Solve problems involving motion of particles in fluid, fluidÃ¢â‚¬â€œsolid operations in packed beds and fluidized beds

UNIT IV [CO:4] **(15)**

Transportation of fluids: Introduction to: pipe and tubing, joint and fittings, gate valves and globe valves, plug cocks and ball valves, check valves. Pumps: Types, Selection, Applications, Performance characteristics of centrifugal and reciprocating pumps, Constructional features and working principle of jet ejectors, compressors.

Metering of fluids: Constructional features and working principles of: venturi meter, orifice meter, Rota meters, Pitot tube, target meters, vortex-shedding meter, turbine meter, magnetic meters.

LEARNING RESOURCES:

TEXT BOOK:

Unit Operations of Chemical Engineering, Warren L.McCabe, Julian C.Smith, Peter Harriot, 7thEdition, McGraw Hill.

REFERENCE BOOK(s):

1. Perrys Chemical Engineers Hand Book, Robert H. Perry, 8th edition, McGraw Hill (2007).
2. Coulson and Richardsons Chemical Engineering, Volume-1, J.F. Richardson, J. H. Harker