UCH302 PROCESS FLUID MECHANICS

L	T	P	Cr
3	1	2	4.5

Course Objective:
To understand basic concept of fluid flow and its application to chemical process industries including pipe flow, fluid machinery and agitation & mixing.

Introduction: Basic fluid concepts, Velocity and stress fields, Classification of fluids.

Fluid Statics: Basic equations for pressure field, Manometers.

Fluid Kinematics: Methods of describing fluid motion, Velocity and acceleration of a fluid particle, Type of fluid flows, Circulation and vorticity, Potential and stream functions.

Fluid Dynamics: Euler's equation of motion, Bernoulli's equation, Momentum equation, Kinetic energy and momentum correction factors.

Dimensional Analysis: Methods of dimensional analysis, Rayleigh method and Buckingham π-theorem.

Flow through Pipes: Laminar and turbulent flows, Friction factor, Moody's chart, K-factors, Valves, Pipe networks.

Flow Measuring Devices: Impinging jet, Pitot tube, Orifice and venturi meter, Rotameter, V-notch and weirs, Water current meter.

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

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

Laboratory Work:
Verification of Bernoulli's theorem, Calibration of venturimeter, Centrifugal pumps characteristic curves, Calibration of orifice meter, Determination of friction factor for pipes of different materials, Determination of hydraulic coefficients of an orifice, Verification of momentum equation, Determination of loss coefficients for various types of pipe fittings, Calibration of a triangular notch, Calibration of rotameter, Visualization of laminar and turbulent flow.

Course Learning Outcomes (CLO)
The students will be able to:

1. calculate shear force, pressure, and various kinematic quantities
2. analyze fluid flow problems involving the application of the momentum and energy equations

3. analyze fluid flow problems with dimensional analysis
4. solve the problems related to pipe flows and fluid machinery

Text Book:

1. *Cengel, Y. A., Fluid Mechanics Fundamentals and Applications (in SI units), Tata McGraw-Hill (2010).*

Reference Books:

1. *McCabe, W., Smith, J. and Harriot, P., Unit Operations of Chemical Engineering, McGraw-Hill (2005).*
2. *Levenspiel, O., Engineering Flow and Heat Exchanger, Springer (1998).*
3. *Foust, A.S., Wenzel, L.A., and Clump C.W., Principles of Unit Operations, John Wiley (2008).*
4. *Fox, R.W., McDonald, A.T, and Pritchard, P.J., Introduction to Fluid Mechanics, John Wiley (2008).*
5. *Wilkes, J.O., Fluid Mechanics for Chemical Engineers with Microfluidics and CFD, Prentice Hall of India (2005).*
6. *Denn, M., Process Fluid Mechanics, Prentice Hall (1979).*
7. *Kumar, D.S., Fluid Mechanics and Fluid Power Engineering, Kataria & Sons (2009).*

Evaluation Scheme:

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