

CH 202 FLUID FLOW OPERATIONS

CREDITS= 6 (L = 4, P = 4)

- 1 **Review of fluid statics:** Definition of fluid; surface tension; capillarity; vapor pressure; bulk modulus. Pressure at a point; fluid forces on plane and curved surfaces. Pressure measurement.
- 2 **Kinematics of flow:** Types of flow; definitions and classifications of steady, unsteady, uniform, non-uniform, laminar and turbulent flows, stream lines, stream tubes, velocity, velocity potential & stream function.
- 3 **Integral analysis of flow:** Equation of continuity (Euler's equation); Bernoulli's equation. Applications of Bernoulli's equation.
- 4 **Elements of model studies:** similitude; dimensionless numbers & forces; scaling up.
- 5 **Viscous flow:** Flow in circular & non-circular pipes and parallel plates. Calculation of pressure drop and friction.
- 6 **Boundary layer theory:** Concept of boundary layer; boundary layer growth along a flat plate. Boundary layer thickness.
- 7 **Turbulent flow:** Definition. Prandtl's mixing length; velocity distribution for flow through pipe. Darcy's equation; losses in pipe-fittings and valves.
- 8 **Introduction to flow of Compressible fluids:** Sound wave and Mach number; energy equation; surges; water hammer.
- 9 **Flow past immersed bodies:** Drag coefficients; Flow through packed and fluid bed; Stock's law, Newton's law and terminal setting velocity.
- 10 **Transportation and metering of fluids:** Centrifugal & rotary pumps, their selection & pump characteristics; fans, blowers and compressors; Flow meters, magnetic flow measurement.
- 11 **Agitation and mixing of liquid:** Equipment; power consumption in agitation systems.
- 12 **Introduction to multi-phase flow.**

REFERENCE BOOKS:

Title: Unit operations of chemical engineering
Author: W C McCabe & J C Smith
Publisher: McGraw Hill, 3rd edition

Title: Chemical engineering, vol. I
Author: J M Coulson and J F Richardson
Publisher: Pergamon press

Title: Perry's Handbook for Chemical Engineers
Author: J H Perry & Chilton
Publisher: McGraw Hill