**ME 221 Fluid Mechanics II (3-0-0-6)**

*Pre-requisite: Fluid Mechanics I or Equivalent*

Viscous flows– Demonstration of simple analytical approach, channel flow, entrance length, fully-developed flow, friction factor and head losses, Darcy-Weisbach equation, basic introduction to turbulent flows, Boundary Layer Theory; Derivation of Boundary Layer equation and thin shear layer approximation, Order of magnitude analysis, Displacement, Momentum and Energy thickness, Karman momentum-integral equation, Blasisus boundary layer over flat plate, Effect of pressure gradients, flow separation and its application; Compressible Flow–Regimes of compressible flow, Definition of Mach number and speed of sound, Adiabatic and isentropic steady flow, Governing equations for 1 –D inviscid flows, Stagnation properties, Isentropic flow with area change, convergent, divergent and convergent-divergent nozzles, Choked flow and effect of pressure ratio, Rankine-Huginiot relations and introduction to shocks; Hydraulic Machines–Euler pump/turbine equation, classification of hydraulic machines, Impulse momentum principle, velocity triangles, efficiency, Centrifugal and Axial pumps, velocity triangles and analysis, effect of blade angle, cavitation, NPSH, priming and testing of pumps, specific speed, characteristic curves, series and parallel operations, system resistance and selection, Pelton turbines: working principle, velocity triangles, performance characteristics, effect of number of buckets and multi-jets, efficiency, Reaction turbine: Degree of reaction, Francis and Kaplan turbines, velocity triangles and analysis, draft tube, specific speed, efficiency, Positive displacement pumps: Working principle, indicator diagram, efficiencies, effect of air vessel, slip and characteristic curves.

**Texts:**

[1] F. M. White, Fluid Mechanics, Tata McGraw-Hill, 2008.
[2] R. W. Fox, A.T. McDonald and P.J. Pritchard, Introduction to Fluid Mechanics, John Wiley, 2004

**References:**

[1] B. R. Munson, D.F. Young, and T.H. Okhiishi, Fundamentals of Fluid Mechanics, Wiley India Edition, 2002.
[2] J. D. Anderson (Jr.), Modern Compressible Flow, McGraw-Hill, 1990.
[3] Y. A. Cengel and J.M. Cimbala, Fluid Mechanics, Tata McGraw-Hill, 2006.
[4] J. F. Douglas, J. M. Gasiorek, J. A. Swaffield and L. B. Jack, Fluid Mechanics, Pearson Education, 2008.
[5] S. L. Dixon, and C. A. Hall, Fluid Mechanics and Thermodynamics of Turbomachinery, Elsevier, 2014.