ME 214 Fluid Mechanics - I (2-1-0-6)

Introduction; Basic ideas of continuum, fluid properties including viscosity, surface tension and vapour pressure, Fluid Statics: Hydrostatic pressure distribution, Manometry, Forces on submerged bodies, Buoyancy and Floatation, Stability of floating bodies, Pressure distribution in rigid body motion, Fluid Kinematics: Lagrangian and Eulerian descriptions, Deformation of fluid element, Strain rates, Vorticity, Flow description using pathline, streamline and streak line, Conservation laws: Reynolds Transport Theorem, Integral form of conservation laws – mass, linear momentum, angular momentum and energy, Differential form of conservation laws, Elementary derivation of Navier-Stokes equations, Exact solution to Navier-Stokes equations: Couette flow and Poiseulle flow, Inviscid flows: Bernoulli equation and applications, overview of various losses. Plane potential flows: Streamfunction-velocity potential, superposition, source, sink, Doublet, Rankine half body, flow past a cylinder, circulation, D'Alembert's Paradox. Dimensional analysis: Buckingham Pi theorem, dimensionless groups, similitude laws and scaling, practical applications.

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
[3] B. R. Munson, D. F. Young and T. H. Okhiishi, Fundamentals of Fluid Mechanics, Wiley India Edition, 2002.

References:

[1] J. F. Douglas, J.M. Gasiorek, J. A. Swaffield and L.B. Jack, Fluid Mechanics, Pearson Education, 2008.
[2] Y. A. Cengel and J.M. Cimbala, Fluid Mechanics, Tata McGraw-Hill, 2006.
[3] M. C. Potter, D. C. Wiggert and B. H. Ramadan, Mechanics of Fluids, Cengage Learning, 2012.