JF 207 Introductory Course Instructor: Ganesh S
Credits: 3:0 Fluid Mechanics

Fluid kinematics: Continuum hypothesis, Flow description and visualization, Decomposition of relative motion.
Conservation laws: Conservation of mass, momentum and energy, Constitutive equations.
Elementary kinetic theory: molecular perspective of thermodynamics, probabilistic picture of molecular motion, expression for transport coefficients.
Cartesian vectors and tensors.
Solutions to the Navier-Stokes equations: Hydrostatics, Uni-directional flows, Low Reynolds number flows, Lubrication theory.
Vorticity dynamics: Kelvin's Circulation Theorem, Sources of vorticity production, Canonical vortex structures, Dynamics of rotating fluids.
Hydrodynamic stability: the Kelvin-Helmholtz and Rayleigh-Taylor mechanisms.
A brief introduction to turbulence.
Potential flows: Bernoulli's theorem, complex-variable formulation for plane potential flows.
Boundary layer theory: Introduction to singular perturbation theory, Boundary layer on a flat plate, Falkner-Skan solutions, Separation.
Compressible flows: Sound waves, Flow in a converging-diverging nozzle, Shocks, The Riemann problem.
An introduction to non-Newtonian fluid mechanics.

Books:
1. Fluid mechanics - Kundu, Cohen and Hu.
2. Advanced transport phenomena - Leal
3. Introduction to fluid dynamics - Batchelor
4. Fluid mechanics - Landau and Lifschitz
5. Rotating fluids - Greenspan
6. Waves in fluids - Lighthill
7. Vectors, tensors and basic equations of fluid mechanics - Aris, Rutherford