

Module Code: MATH-415
Module Title: **Fluid Mechanics-I**
Module Rating: 3 Cr. Hours

Conservation of Matter

- Introduction
- Fields and continuum concepts
- Lagrangian and Eulerian specifications
- Local, convective and total rates of change
- Conservation of mass
- Equation of continuity
- Boundary conditions

Nature of Forces in a Fluid Field and their Effects

- Surface and body forces
- Stress at a point
- Viscosity and Newton's viscosity law
- Viscous and inviscid flows
- Laminar and turbulent flows
- Compressible and incompressible flows

Irrotational Fluid Motion

- Velocity potential from an irrotational velocity field
- Streamlines
- Vortex lines and vortex sheets
- Kelvin's minimum energy theorem
- Conservation of linear momentum
- Bernoulli's theorem and its applications
- Circulations, rate of change of circulation (Kelvin's theorem)
- Axially symmetric motion
- Stokes's stream function

Two-dimensional Motion

- Stream function
- Complex potential and complex velocity, Uniform flows
- Sources, sinks and vortex flows
- Flow in a sector
- Flow around a sharp edge, Flow due to a doublet

Recommended Books

1. H. Schlichting, K. Gersten, E. Krause and H. Oertel, Jr.: *Boundary-Layer Theory*, 8th edition (Springer, 2004).
2. Yith Chia-Shun: *Fluid Mechanics* (McGraw Hill, 1974).
3. I. L. Distworth: *Fluid Mechanics* (McGraw Hill, 1972).
4. F. M. White: *Fluid Mechanics* (McGraw Hill, 2003).
5. I. G. Curie: *Fundamentals of Mechanics of Fluids*, Third edition (CRC, 2002).
6. R. W. Fox, A. T. McDonald and P. J. Pritchard: *Introduction to Fluid Mechanics* (John Wiley and Sons, 2003).

