ME603 Advanced Fluid Mechanics

Credit: 3-0-0-3 Approval: Approved in 2nd Senate

Prerequisites: Fluid Mechanics

Students intended for: MS/PhD

Elective or Compulsory: Elective Semester: Odd/Even

Course content:

- **Introduction:** Eulerian and Lagrangian description of flow; Motion of fluid element-translation, rotation and deformation; vorticity and strain-rate tensors; Continuity equation, Cauchy's equations of motion, Derivation of Navier-Stokes equations for compressible flow.
- **Exact solutions of Navier-Stokes equations:** Plane Poiseuille flow and Couette flow, Hagen-Poiseuille flow, flow between two concentric rotating cylinders, Stokes first and second problems, flow near a rotating disk, flow in convergent-divergent channels.
- **Slow viscous flow:** Stokes and Oseen's approximation, theory of hydrodynamic lubrication.
- **Boundary layer Analysis:** Derivation of boundary layer equations; Exact solutions; Approximate methods; Momentum integral method.
- **Stability:** Introduction to hydrodynamic stability, Orr-Sommerfeld equation.
- **Introduction to Turbulence:** Description of turbulent flow, averaging, RANS, Introduction to turbulent models, Empirical laws.

Text & Reference Books:

White F M, Viscous Fluid Flow, 3rd Ed, Tata McGrawhill, 2011.

Cebeci T and Bradshaw P, Momentum Transfer in Boundary Layers, McGrawHill, 1977.

Schlichting H and Gersten K, Boundary Layer theory, 8th Ed, Springer, 2000.

Kundu P K and Cohen I M, Fluid Machanics, 4th Ed, Elsevier, 2005.

Other Faculty Members interested in teaching this course:

Proposed by: Dr. P Anil Kishan School: