Syllabus: ME 2074 Advanced Fluid Mechanics

- Review of Kinematics
  Lagrangian, Eulerian Representation, Voriticy, Special Motions

- Review of Governing Equations
  Integral Equations for a system
  Local Equations in Lagrangian Formulation
  Local Equations in Eulerian Formulation
  Integral Equations for a Control Volume

- Review of Constitutive Equations
  Inviscid Compressible, Inviscid Incompressible, Linearly Viscous Compressible, Linearly Viscous Incompressible.

- Viscous Fluids

  - Exact Solutions
  - Jeffrey-Hammel Flow in a Channel and Cone
  - Corner Flows
  - Introduction to Existence, Uniqueness and Stability
    * Turbulence in a Pipe
    * Taylor Vortices

- Inviscid Fluids

  - Euler's Equation
  - Bernouilli's Equation, Crocco's Equation
  - Vorticiy/Stream Function Formulation
  - Some Exact Solutions
  - Kelvin's Theorem
  - Helmholtz Theorem
  - D'Alembert's Paradox
  - Fluid Mechanics Film Discussion

- Approximations to Navier-Stokes Equations

  - Non-dimensionalization
  - Stokes Flow
    * Uniform Flow Past a Sphere
      Exact Solution,
    * Uniform Flow Past A Circular Cylinder
      Stokes Paradox, Extensions of Stoke's theory
  - Thin Films
    * Lubrication Theory
    * Squeeze Films
    * Thin Films with Free Surfaces
    * Hele-Shaw Flow
  - Boundary Layer Theory

- Stability of Fluid Motions