

**ME 503  
Fluid Dynamics I  
(3 credit hours)**

**Objectives**

1. Learn about nature of and stresses in fluids
2. Learn and apply principles of fluid statics and buoyancy
3. Learn formulation and applications of control volume analysis
4. Learn and apply Bernoulli's equation and differential formulation

**Topics**

1. Introduction, Applications, and Vector Algebra
2. Fluid Statics
3. Rigid Body Motion
4. Control Volumes and Fluxes
5. Nozzles, Elbows, and Orifices
6. Differential Analysis
7. Kinematics of Fluids
8. Euler's Equations, Bernoulli Equation, and Pressure Measurements

**Prerequisites**

ME 250, Numerical Methods in Mechanical Engineering  
ME 501, Thermodynamics I

Before taking this class, the students should specifically know:

1. Vector calculus
2. Ordinary differential equations
3. Partial differential equations
4. Basic physics

**Basis of Grading**

1. One or two midterms
2. Final
3. Homework

1. Area as a vector
2. Body and surface forces
3. Pressure
4. Stress
5. Viscosity
6. Flow lines

1. Forces on submerged bodies
2. Forces on submerged curved surfaces
3. Buoyancy, stability of floating and submerged objects
4. Rigid body translation
5. Rigid body rotation

1. Conservation of mass for control volume
2. Conservation of linear momentum for control volume
3. Bernoulli equation, venturi, and orifice
4. Pressure measurements

1. Conservation of angular momentum for control volume
2. Control volumes with arbitrary acceleration
3. First and Second Laws of thermodynamics for control volume

1. Stream function and velocity potential
2. Rotation and vorticity
3. Differential form of momentum equation and Navier-Stokes equations
4. Euler's and Bernoulli's equations