

# Course Outline

AME 309...Spring 2013

Required Text: *Basic Fluid Mechanics, Fifth Edition*, David C. Wilcox  
Earlier editions of the text are inappropriate for this course. There have been significant changes in nomenclature, material included and homework problems.

Class web site: <http://www.dcwindustries.com/309>

1. BASIC CONCEPTS (Week 1)
  - Vector Calculus Review
  - Dimensions and Units
  - Pressure, Surface Tension, Viscosity, Couette and Pipe Flow
2. DIMENSIONAL ANALYSIS (Weeks 2-3)
  - Buckingham II Theorem
  - Similitude
3. EFFECTS OF GRAVITY ON PRESSURE (Weeks 3-4)
  - Hydrostatic Pressure, Pressure Measurement Techniques
  - Hydrostatic Forces on Plane Surfaces
  - Hydrostatic Forces on Curved Surfaces
  - Buoyancy
4. KINEMATICS (Weeks 4-5)
  - Eulerian and Lagrangian Descriptions
  - Streamlines, Streaklines, Pathlines
  - Vorticity and Circulation
  - Reynolds' Transport Theorem
5. MASS AND MOMENTUM PRINCIPLES (Weeks 6-7)
  - Integral Form of the Mass and Momentum Principles
  - Continuity and Euler Equations
  - Galilean Invariance of Euler's Equation
  - Bernoulli's Equation
  - Pitot and Pitot-Static Tubes

6. CONTROL-VOLUME METHOD (Weeks 7-9)

- Stationary and Moving Control Volumes
- Deforming Control Volumes
- Indirect Force Computation, Reaction Force
- Accelerating Control Volumes

7. ENERGY PRINCIPLE (Weeks 9-11)

- Thermodynamics
- Energy Equation in Integral and Differential Form
- Approximate Methods
- Pipe Flow

8. ONE-DIMENSIONAL COMPRESSIBLE FLOW (Weeks 12-13)

- Importance of Mach Number
- Isentropic Flow
- Normal Shock Waves
- Laval Nozzle

9. POTENTIAL FLOW (Weeks 13-15)

- Velocity Potential and Streamfunction
- Fundamental Solutions
- Flow Past a Cylinder
- Circulation and Lift
- Accelerating Cylinder
- Linear Airfoil Theory

10. VORTICITY AND VISCOSITY (Week 15)

- Vortex Force, Helmholtz Theorem, d'Alembert's Paradox
- Viscous Effects and Vorticity Generation
- Lift and Drag of Common Objects