

Course Outline

AME 309...Spring 2010

Required Text: *Elements of Fluid Mechanics*, David C. Wilcox

Brand new copies are available directly from the publisher for \$74.95, which includes California sales tax and the cost of shipping. To qualify for the discount, place your order at <http://www.dcwindustries.com/books/1928729177.htm> and be sure to note that you are one of Dr. Wilcox's students in AME 309 this spring.

NOTE: A more-detailed AME 309 course website is located at <http://www.dcwindustries.com/ucla>

1. BASIC CONCEPTS (Week 1)
 - Basic Definitions
 - Dimensions and Units
 - Pressure, Surface Tension, Viscosity, Couette and Pipe Flow
2. DIMENSIONAL ANALYSIS (Weeks 2-3)
 - Buckingham II Theorem
 - Similitude
3. PRESSURE (Weeks 3-4)
 - Hydrostatic Pressure, Pressure Measurement Techniques
 - Bernoulli's Equation, Velocity Measurement Techniques
 - Hydrostatic Forces on Plane Surfaces and Curved Surfaces
 - Buoyancy
4. KINEMATICS (Weeks 4-5)
 - Eulerian and Lagrangian Descriptions
 - Streamlines, Streaklines, Pathlines
 - Vorticity and Circulation
 - Reynolds' Transport Theorem
5. CONSERVATION OF MASS AND MOMENTUM: INTEGRAL FORM (Weeks 7-8)
 - Derivation of Integral Conservation Principles
 - Control-Volume Method
 - Stationary and Moving Control Volumes

- Deforming Control Volumes
 - Indirect Force Computation, Reaction Force
 - Accelerating Control Volumes
6. CONSERVATION OF ENERGY: INTEGRAL FORM (Weeks 8-11)
- Thermodynamics
 - Derivation of the Energy Conservation Law
 - Approximate Methods
 - Pipe Flow
 - Open-Channel Flow
7. ONE-DIMENSIONAL COMPRESSIBLE FLOW (Weeks 12-13)
- Importance of Mach Number, Total Conditions
 - Normal Shock Waves
 - Laval Nozzle
8. CONSERVATION LAWS: DIFFERENTIAL FORM (Weeks 13-14)
- Reynolds' Transport Theorem at a Point
 - Continuity Equation, Euler's Equation, Energy Equation
 - Entropy Generation
 - Derivation of Bernoulli's Equation
 - Galilean Invariance of Euler's Equation
9. POTENTIAL FLOW (Weeks 14-15)
- Velocity Potential and Streamfunction
 - Fundamental Solutions
 - Flow Past a Cylinder
 - Circulation and Lift
 - Accelerating Cylinder
10. VORTICITY AND VISCOSITY (Weeks 15-16)
- Vortex Force, Helmholtz Theorem, d'Alembert's Paradox
 - Viscous Effects and Vorticity Generation
 - Navier-Stokes Equation
 - Lift and Drag of Common Objects