ME 3250 FLUID MECHANICS I
(Fall 2015)

Class Meeting MWF 10:10 – 11:00 am, AUST 163

Instructor Tai-Hsi Fan, Associate Professor
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TA office and office hours are to be determined

Prerequisite Multivariable calculus, thermodynamic principles, differential equations


Course Objective and Policy
The Program Educational Objectives, ABET Syllabi, and ASME Code of Ethics are available at http://www.engr.uconn.edu/me/cms/undergraduate/currentstudents/syllabicourses

ME3250 is a junior-level Fluid Mechanics. The goals of this course for students to achieve are: (1) To understand basic fluid properties, fluid statics, dynamics, kinematics, and flow regimes; (2) To learn the differential and integral techniques commonly used in formulating and solving fluid flow problems; (3) To apply dimensional analysis such as Pi theorem and develop a strategy for solving engineering problems; (4) To prepare a foundation for advanced courses in thermal-fluid sciences.

There will be no computer programming involved in this course. Homework assignments will be made on an approximately weekly basis. Students may discuss homework problems with classmates or the TA, but the collected works must be individual effort. Using solution manual from the textbook publisher or other resources is strictly prohibited. No late homework will be accepted. Selected homework problems will be practiced during the lectures.

Grade Determination
Homework (10%), mid-term I (20%), mid-term II (20%), mid-term III (20%), final exam (30%). No make-up exams will be given except as required by the University policy.

Course Outlines
• Introduction to Fluid Mechanics (Ch.1)
  Dimensional homogeneity, units
  Fluid viscosity, density, pressure, and stress

• Hydrostatics (Ch.2)
  Pressure variation in a gravity field, buoyancy
  Hydrostatic equation
  Hydrostatic force on a plane surface and a curved surface
  Linear acceleration and rigid body rotation

• Inviscid Fluid Dynamics (Ch.3)
  Flow along a streamline, flow across a streamline
Derivation of Bernoulli equation
Static and dynamic pressures
Applications of Bernoulli equation

- **Midterm I** (10:10 – 11:00 am, AUST 163)
- Fluid Kinematics (Ch.4)
  - Eulerian and Lagrangian descriptions
  - Material derivative, acceleration
  - Derivation of Reynolds Transport Theorem
- Control Volume Analysis (Ch.5)
  - Integral versus differential analysis
  - Conservation of mass
  - Conservation of momentum, angular momentum
  - Conservation of energy
- **Midterm II** (10:10 – 11:00 am, AUST 163)
- Differential Analysis (Ch.6)
  - Continuity equation
  - Equation of motion
  - Euler's equation, Bernoulli equation revisited
  - Stress, strain, and strain rate
  - The Navier-Stokes equations
  - Typical analytical solutions for laminar flows
  - Introduction of potential flow, stream function, velocity potential, vorticity
- **Midterm III** (10:10 – 11:00 am, AUST 163)
- Dimensional Analysis (Ch.7)
  - Buckingham Pi theorem
  - Scaling and similitude analysis
- Viscous Flow in Pipes (Ch. 8)
  - Characteristics of laminar and turbulent flows
  - Entrance and fully developed regions
  - Dimensional analysis
- **Comprehensive Final Exam** (2 hr exam, AUST 163)