

## CHEE 3363: Fluid Mechanics for Chemical Engineers

**Spring 2011**

**Section:** 31763

**Lecture:** 4:00–5:30pm, MW

**Location:** D3 E220

**Catalog data:** Cr. 3 (3-0).

**Prerequisites:** CHEE 2332, MATH 3321, and credit for/concurrent enrollment in CHEE 3343.

**Description:** foundations of fluid mechanics, fluid statics, kinematics, laminar and turbulent flow; macroscopic balances; dimensional analysis and flow corrections.

**Instructor:** Dr. Jacinta C. Conrad (jconrad@uh.edu), S226 Engineering Building 1

**Office hours:** M, 9:15–11:15am or by appointment

**Teaching Assistant:** Tu Nguyen (thnguyen24@uh.edu), S334A Engineering Building 1

**Office hours:** M, 1:00–2:30pm

### Recommended Reading:

There is no required textbook for this course. This course will be taught from lecture notes prepared by the instructor and posted on Blackboard. The recommended texts are given as supplements and references; the instructor recommends that you purchase at most of the following:

- Fox, Pritchard, and McDonald, Introduction to Fluid Mechanics, any edition. (8th ed. (2009) available at bookstore.)
- Munson, Young, and Okiishi, Fundamentals of Fluid Mechanics, any edition. (5th ed. available at bookstore.)
- Street, Watters, and Vennard, Elementary Fluid Mechanics, 7th ed., 1996.

### Prerequisite topics:

- Engineering thermodynamics
- Engineering mechanics: fundamental laws; statics and dynamics
- Stress and strain; elastic material behavior
- Vectors, vector analysis and operations
- Calculus and differential equations

### Topics:

- Introduction to fluid mechanics, introduction to dimensional analysis, review of vector analysis and operations (2 classes)
- Fundamental laws and principles, stress analysis, force on a body, constitutive equations (1–2 classes)
- Fluid statics and fluids in rigid body motion (2–3 classes)
- Macroscopic mass and linear momentum equations and applications (3 classes)

**Exam 1: Saturday, February 26, 2011 [only above material covered]**

- Macroscopic angular momentum equations and application (1 class)
- Macroscopic energy balance, Bernoulli's equation, applications (3 classes)
- Viscous flows; Newtonian and non-Newtonian fluids, basic equations of motion (4 classes)
- Dimensional analysis in fluid mechanics (1 class)
- Laminar flow in piping systems (1 class)

**Exam 2: Saturday, April 2, 2011**

- Turbulent flow in piping systems (1 class)
- External flows, boundary layer theory, momentum integral equation (2–3 classes)
- Flow measurement, compressible and isentropic/adiabatic flow (2–3 classes)
- Special topics: microfluidics and/or biofluid flows (1–2 classes)

**Final project due: Saturday, April 30, 2011, 5pm**

- Course review (1 class)

**Final exam: Friday, May 6, 2011, 5–8pm**

**Evaluation:** Grades will be determined on the basis of exams, quizzes/in-class problems, attendance and submitted homework grades with the following **approximate** weights. The actual weights will be fixed at the end of the semester.

- Homework: 5–10%
- Quizzes/in-class problems: 10–15%
- Two exams: 15–25% each, total 40%
- Final exam: 35–45%
- Design project: 5–10%

**Exam policies:**

- All exams are mandatory.
- No makeup exams will be given.
- All exams, save the final, will be given on Saturday.
- All regrade requests **MUST** be put in writing, and submitted at one time no later than one week after exams are returned.
- All questions on an exam submitted for regrading will be regraded.

**Special dates:**

- January 25, 2011: Last day to add a course.
- February 2, 2011: Last day to drop a course or withdraw without receiving a grade.
- March 15-19, 2011: Spring break
- April 5, 2011: Last day to drop a course or withdraw with a “W.”

**Academic dishonesty:**

- Please see section 3.02 for the University of Houston policy on academic dishonesty.
- The instructor takes academic dishonesty very seriously.
- All items capable of transmitting and/or receiving wireless signals in an exam room are expressly forbidden. This includes but is not limited to: cell phones, pagers, PDAs, and laptops.

**ABET Outcomes Assessment:**

*Outcome 1:* Students will demonstrate a knowledge of the fundamentals of fluid mechanics (*a*).

*Outcome 2:* Students will demonstrate the ability to use various techniques for analyzing problems with frictional flow (*a,c*).

*Outcome 3:* Students will demonstrate an understanding of the basics of boundary layer theory for use in transport of heat and mass (*a*).

*Outcome 4:* Students will demonstrate the ability to apply fluid mechanics principles and their relevance to engineering and the ability of these to solve societal problems (*e*).

**ABET Criterion 3: Program Outcomes and Assessment:**

*a* an ability to apply knowledge of mathematics, science, and engineering

*b* an ability to design and conduct experiments, as well as to analyze and interpret data

*c* an ability to design a system, component, or process to meet desired needs

*d* an ability to function on multi-disciplinary teams

*e* an ability to identify, formulate, and solve engineering problems

*f* an understanding of professional and ethical responsibility

*g* an ability to communicate effectively

*h* the broad education necessary to understand the impact of engineering solutions in a global and societal context

*i* a recognition of the need for, and an ability to engage in, life-long learning

*j* a knowledge of contemporary issues

*k* an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice