CHEE 3363: Fluid Mechanics for Chemical Engineers

Spring 2013
Section: 17777
Lecture: 4:00–5:30pm, MW
Location: CBB 108
Catalog data: Cr. 3 (3-0)
Prerequisites: CHEE 2332, MATH 3321, and credit for/concurrent enrollment in CHEE 3334 (soft).
Description: foundations of fluid mechanics, fluid statics, kinematics, laminar and turbulent flow; macroscopic balances; dimensional analysis and flow corrections.

Instructor:
Dr. Jacinta C. Conrad (jcconrad@uh.edu), S226 Engineering Building 1
Office hours: M, 9:30–11:30am, immediately after class (MW 5:30–6:30pm), or by appointment

Teaching Assistants:
Firoozeh Babaye Khorasani (fbabayekhorasani@uh.edu), S334A Engineering Building 1
Office hours: TBD
Jinsu Kim (jkim76@uh.edu), S334A Engineering Building 1
Office hours: W, 9–11am
Rahul Pandey (rpandey2@uh.edu), S334A Engineering Building 1
Office hours: W, 10am–12pm

Required Reading: Fox, Pritchard, and McDonald, Introduction to Fluid Mechanics, any edition. (8th ed. (2011) available at bookstore.)
Recommended Reading: Munson, Young, and Okiishi, Fundamentals of Fluid Mechanics, any edition.

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 23, 2013

- 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)

Exam 2: Saturday, March 30, 2013

- Laminar flow in piping systems (1 class)
- 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)
- Course review (1 class)

Final project due: Tuesday, April 30, 2013, 5pm (by email)
Final exam: Monday, May 6, 2013, 5–8pm

Evaluation: Grades will be determined on the basis of exams, quizzes/in-class problems, attendance and submitted homework grades with the following weights:

- Homework: 10%
- Quizzes: 10%
- Two exams: 20% each, total 40%
- Final exam: 35%
- Design project: 5%

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.
- No electronic devices of any sort are permitted.

Special dates:

- January 22, 2013: Last day to add a course.
- January 30, 2013: Last day to drop a course or withdraw without receiving a grade.
- March 11–16, 2013: Spring break
- March 27, 2013: 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