CHEE 3363: Fluid Mechanics for Chemical Engineers

Spring 2012
Section: 18640
Lecture: 4:00–5:30pm, MW
Location: D3 E320
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, 9:15–11:15am or by appointment

Teaching Assistants:
Jinsu Kim (jkim76@uh.edu), S334A Engineering Building 1
Office hours: W, 10:00–11:30am
Rahul Pandey (rpandey2@uh.edu), S334A Engineering Building 1
Office hours: Th, 10:00–11:30am

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 25, 2012 [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)

Exam 2: Saturday, March 24, 2012

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)

Final project due: Saturday, April 28, 2012, 5pm (by email)

Course review (1 class)

Final exam: Wednesday, May 9, 2012, 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.

Special dates:

- January 24, 2012: Last day to add a course.
- February 1, 2012: Last day to drop a course or withdraw without receiving a grade.
- March 12–17, 2012: Spring break
- April 3, 2012: 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