CE 100 Elementary Fluid Mechanics - Course syllabus (draft) Fall 2014

Instructor

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Office hours: Mon. 11am-12pm, Wed. 11am-1pm, in 621 Davis Hall, or by appointment

Lectures: MWF 10-11am, 3 LeConte Hall
Lab/discussion: M 4-5pm, M 5-6pm, W 4-5pm (212 O'Brien)
Class website: http://bcourses.berkeley.edu

Teaching assistants

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Office hours: Tu 10:30-11:30, Th 11-2:00pm, in 651 Davis Hall

Overview

This is an introductory course on fluid motion, the forces that fluids exert, and the forces that are exerted on them. The study of fluid mechanics has numerous engineering applications. Fluids interact with structures such as high-rise buildings, dams, and bridges and the static and dynamic loads imposed by the fluids must be considered in the design and construction of these structures. Cars, aircraft, and ships all move through fluids, and frictional (fluid drag) forces represent a major energy sink. Water is an important resource to California and fluid mechanical problems abound in the complex system of dams, aqueducts, treatment plants, pipes, and valves used to deliver water to urban and agricultural consumers. Finally, the motions of contaminants in water and air are governed by the mechanics of fluid flow.

After this course, we hope you will enroll in one or more of the upper division elective courses: CE101 (Fluid Mechanics of Rivers, Streams and Wetlands), CE103 (Hydrology), CE 105 (Environmental Fluid Mechanics Design), CE111 (Environmental Engineering), and CE173 (Groundwater and Seepage). If you wish to specialize in these areas, you will also find a broad range of courses at the graduate level: environmental fluid mechanics, environmental flow modeling, transport and mixing in surface waters, coastal processes, physical oceanography, groundwater flow, and others.

Course objectives

By the end of this course, you should expect to be able to calculate:

- fundamental fluid properties for different fluids and flows
- forces on objects submerged in both static and flowing fluids
- pressures in both static and flowing fluids, and the velocities associated with different flows
- forces in complicated momentum balance problems
- energy loss and the flow rates associated with different flow networks in channels and pipes
- dimensionless numbers important for design of experiments and practical engineering work
- numerical solutions for simple fluid flow problems using Matlab
- properties of a boundary layer, both turbulent and laminar
- water depth variation for flows in rivers and channels

You should also expect to:

- tap into your existing intuition, strengths, and passions to learn fluid mechanics
- get to know your classmates and instructors well

- become an active participant in your fluids education, taking full advantage of lectures, texts, homework, office hours, multimedia, and everyday life

COURSE LOGISTICS

Course website: bcourses.berkeley.edu The website will be used to post homework assignments and solutions, practice exams, etc. An online discussion forum is available to discuss questions with your classmates and instructors. You can also check your grades online.

Textbook and reading assignments: *Fundamentals of Fluid Mechanics*, 7th edition, by Munson, Okiishi, Huebsch, and Rothmayer, published by John Wiley & Sons. On reserve at the Engineering Library. You are responsible for the material in the assigned sections of the textbook as well as for what is presented in lecture. Most people learn best when they see material presented several times, in different ways, thus you should read the textbook sections that correspond to each lecture to ensure success. Whether you read the text before or after lecture is up to you – try both and see what works best. The textbook includes a video library online: http://www.wiley.com/college/munson/1118116135/video_lib/mainmenu.html

Homework: Assignments will be posted on the class website and will usually be **due on Fridays by 3pm.** Turn in homework in class or in the drop box outside of 212 O'Brien Hall. Fifteen points will be subtracted for homework turned in after a weekend, and 10 points for each additional weekday late. Late homework will not be given credit after solutions are made available on the website (typically very soon after the due date – on Tuesdays). You will be allowed to *drop your lowest homework score.* While you are encouraged to discuss assignments with each other, you may not look at or copy anyone else's written work.

Computing: Homework and labs will require the use of Matlab, which is available on the computers in Davis Hall 345, 118 McLaughlin Hall, and B4 Evans Hall (for access, see http://www.ce.berkeley.edu/resources/computing/create_lab_account). Matlab-based analyses will include visualization of data and results, curve fitting, parameter estimation, and solving differential equations.

Laboratory and discussion sessions: Each week you will meet with the TAs either for a 50-minute section, which will include discussion/problem solving and presentation of the lab assignments. Labs will be performed with a team, and the laboratory report is due two weeks later (typically on Wednesday). You are expected to contribute fully on the data analysis, data collection, and writing process for all labs. See the lab handout (later) for more details. The lab reports will be marked down 10 points for each day late.

Exams: There will be 2 midterms and a final exam. Material in the exams will be drawn from lectures, the textbook, discussion sections, and lab experiments. Exams are cumulative, so you are responsible for all the material covered before the exam. Collaboration or copying from others during an exam will not be tolerated and may result in zero credit and referral to Student Judicial Affairs.

Grading: Grades will be assigned approximately according to a standard grade scale. Assignments/exams will be weighted as follows:

Homework	20%
Lab reports	18%
Midterm 1	12%
Midterm 2	15%
Final exam	35%

Regrade policy: If there is a grading error, please resubmit the assignment within one week with a note attached explaining the reasons why more credit should be awarded.

Accommodations: If there are any personal matters requiring special accommodations, please inform the instructor as soon as possible.

How to survive this course: Find a study group! Find a study group! Find a study group! (Seriously, this is very important!) Take advantage of office hours! If you have a question, ask it – no matter how silly you think it is. Go to Chi Epsilon tutoring hours! Post questions on the discussion forum online! Enjoy the subject and its numerous applications in science and engineering!

If you or someone you know is having a particularly stressful semester or feeling overwhelmed, I encourage you to call 510-642-9494 to speak with the people at Counseling & Psychological Services. They will provide some personalized and expertly-informed help (at first over the phone, and then in person) and the service is free to all students, regardless of your health care plan. If you or someone you know is in a total emergency, call the Alameda County Crisis hotline: 800-309-2131.

TENTATIVE COURSE SCHEDULE:

Aug. 29 First lecture
Sept. 1 Labor Day holiday
Oct. 10 Midterm exam #1
Nov. 7 Midterm exam #2
Nov. 28 Thanksgiving holiday
Dec. 5 Last lecture
Dec. 15 Final Exam (8-11 a.m. Monday)

Week of	Topics	Text Chapters
Aug. 25	Introduction, fluid properties	1
Sep. 1	(holiday), fluid properties	1
Sep. 8	Hydrostatics, Bernoulli equation	2
Sep. 15	Bernoulli equation	3
Sep. 22	Fluid kinematics, conservation of mass	4, 5.1
Sep. 29	Conservation of momentum, energy	5.1-5.3
Oct. 6	Differential analysis, review, exam	6
Oct. 13	Inviscid flow, Navier-Stokes equations	6
Oct. 20	Dimensional analysis	7
Oct. 27	Viscous flows, Pipe flow	8.1-8.5
Nov. 3	Boundary layers, review, exam	9
Nov. 10	Drag and lift forces	9
Nov. 17	Computational fluid dynamics, drag	9, App. A
Nov. 24	Open channel flow, (holiday)	10.1-10.4
Dec. 1	Open channel flow, review	10.6.1
Dec. 15	Final Exam, 8-11am	