University of Colorado
Department of Civil, Environmental, and Architectural Engineering

CVEN 5313 FALL 2010
Environmental Fluid Mechanics

http://civil.colorado.edu/~crimaldi/teaching/cven5313/

Instructor

name: Professor John Crimaldi
office: ECOT 511
email crimaldi@colorado.edu
office hours: T, Th 2:30-4:30p

Lectures

location: ECCE 1B47
times: T, Th 12:30-1:45p

Prerequisites

math: Multi-variable & Vector Calculus
Differential Equations
fluids: Undergraduate Fluid Mechanics

Course Description

This is a first-year graduate-level course in viscous, incompressible fluid mechanics. Topics include open-channel flow and the Navier-Stokes equations, with an emphasis on applications to natural systems and the environment. The workload consists of regular homework assignments involving challenging, in-depth problems.

Objectives

(1) Develop a mathematical framework and language for describing viscous fluid motion.
(2) Develop an intuitive physical understanding of viscous fluid motion.
(3) Gain an appreciation for the role of fluid mechanics in environmental and biological phenomena.
(4) Gain experience in simplifying complex equations to obtain approximate solutions.
(5) Expand your ability to use a combination of math, pictures, and words to describe complex physical phenomena and communicate them to others.

Lecture Notes

I will provide lecture notes for the course in an electronic format. There is no charge for the notes, and there is no required textbook. I expect that you will have read the notes for the day's lecture in advance. As the notes are new, I encourage you to report any typos and mistakes that you find in the notes.

Course Communications

I will use email as the primary means of communicating with you outside of class or office hours. I may send modifications to assignments, hints, etc., as necessary. You are responsible for checking your official CU email.

Course Requirements

Attendance: Your attendance at all lectures is expected and required.

Participation: A principal tenet of this course is that we can all learn from each other, and that we can learn most effectively in an interactive setting. Therefore, one of the requirements for this class is a commitment on your part to be an active participant in the lectures.

Problem Sets: There will be approximately eight problem sets assigned during the semester. The problem sets will be fairly long, and some problems will require some significant thought before you are able to complete them. You are encouraged to discuss the problem sets with your classmates. **However, the work that you submit should be uniquely your own.**

Grading: The course grading will be based on the following breakdown:

Problem sets	90%
Participation	10%

Honor Code: All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council. Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at http://www.colorado.edu/policies/honor.html

Syllabus

Week	Section	Date	Lecture Topic
1	Open-Channel Flow	24-Aug	Course overview; O-C introduction
		26-Aug	Conservation of Mass, Momentum, and Energy
2		31-Aug	
		2-Sep	Specific Energy
3		7-Sep	
		9-Sep	
4		14-Sep	Uniform Flow
		16-Sep	
5		21-Sep	Gradually Varied Flow
		23-Sep	
6	N-S Preliminaries	28-Sep	Index Notation
		30-Sep	
7		5-Oct	
		7-Oct	Integral Theorems
8	Navier-Stokes	12-Oct	Kinematics
		14-Oct	
9		19-Oct	
		21-Oct	Vorticity and Circulation
10		26-Oct	
		28-Oct	Stream and Potential Functions
11		2-Nov	Conservation of Mass and Momentum
		4-Nov	
12		9-Nov	
		11-Nov	Poiseuille-Couette Flow
13		16-Nov	Conservation of Vorticity
		18-Nov	Conservation of Energy
14		23-Nov	Fall Break and Thanksgiving
		25-Nov	
15		30-Nov	Scaling
		2-Dec	Stokes' 1st and 2nd Problems
16		7-Dec	
		9-Dec	

Suggested Reading

For Open-Channel Flow

[@]Chaudhry, M.H., *Open-Channel Flow*, Springer, 2007

Jain, S.C., *Open-Channel Flow*, John Wiley & Sons, 2001

Sturm, T.W., *Open-Channel Flow*, McGraw Hill, 2001

For Navier-Stokes Equations

[†]Panton, R.L., *Incompressible Flow*, John Wiley & Sons, 1996

[†]Kundu, P.K. and I.M. Cohen, *Fluid Mechanics* (3rd ed.), Academic Press, 2002

[@] Available electronically on Chinook
[†] On Reserve in Engineering Library