MAE 210A – FLUID MECHANICS I
FALL 2014

Instructor
Professor David Saintillan
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Office hours: Monday, Tuesday 1:00 – 2:00pm (or by appointment)

Teaching assistant
Roberto Alonso
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Office hours: Monday 4:00 – 5:00pm in SME 346
Tuesday 4:00 – 5:00pm in SME 347

Lectures
Monday, Wednesday, Friday 11:00 – 11:50am, CSB 005

Course webpage
http://stokeslet.ucsd.edu/mae210a.html

Textbook
Fluid Mechanics
P. K. Kundu, I. M. Cohen, D. R. Dowling

Grading
Homework: 30%   Midterm Exam: 25%   Final Exam: 45%
The worst homework score will be dropped in the course score calculation.

Exams
Midterm exam: November 5th (tentative date, in class)
Final exam: December 16th 11:30am – 2:30pm (location to be announced)
Exams will be open hand-written notes, closed book.

Prerequisites
Undergraduate Calculus (basic differential equations and linear algebra)
Undergraduate Fluid Mechanics (MAE 101A-B, or equivalent)

Course policies
• Unless otherwise noted, homework is due on the due date by the start of the lecture. Late turn-in of homework is not accepted unless approved by the instructor ahead of time.
• Discussion of the course material and homework with your classmates is strongly encouraged, but submitted homework solutions should represent your individual efforts (copying someone else’s solutions or solutions from a book does not qualify).
• You are strongly encouraged to ask questions during the lectures and outside, and to provide the instructor with feedback on the pace or level of the course.
• If you are unable to attend an exam, you must contact the instructor as soon as possible and prior to the exam date. Make-up examinations will only be given in case of an emergency.
• Academic integrity violations will not be tolerated. Any violation of academic integrity (such as cheating or plagiarizing) related to a homework assignment will result in a zero grade for that assignment. Any violation relating to an examination will result in an “F” grade for the course and a possible recommendation for dismissal of the student from the University of California.
• **Basic concepts of continuum mechanics**: statistical and continuum mechanics, the continuum hypothesis, Knudsen number.

• **Mathematical interlude**: vectors and Cartesian tensors, Gibbs and indicial notation, change of coordinate frame, tensor algebra, eigenvalues and eigenvectors, differential calculus, integral theorems.

• **Kinematics of fluid flow**: Lagrangian and Eulerian descriptions, material derivative, flow lines, decomposition of motion, basic flow fields, streamfunctions.

• **Conservation laws**: conservation of mass, conservation of linear and angular momentum, conservation of energy, entropy inequality.

• **Physical properties of fluids**: review of thermodynamics and heat transfer, constitutive equations, Newtonian and non-Newtonian fluids.

• **The Navier-Stokes equations**: compressible and incompressible Navier-Stokes equations, initial and boundary conditions, basic analytical solutions.

• **Dimensional analysis and similarity**: Buckingham-Pi theorem, dimensionless numbers, introduction to self-similarity, flow regimes.

• **Inviscid flows**: Euler equations, general properties of inviscid flows, Bernoulli’s equation.

• **Vortex dynamics**: vorticity equation, production of vorticity, Helmholtz’s equation, Kelvin’s theorem, inviscid motion of point vortices.
GENERAL REFERENCES


SPECIALIZED REFERENCES


