Course Information

Course Instructor Information

Sheryl Grace
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(617) 353 7364

Course meeting time, Office hours

Course time and location: MW 2-4, SOC B65

Office hours: TBD.

Texts

Required: F. White, *Viscous Fluid Flow*, 3rd. Ed., McGraw-Hill, 2006.
Reference: H. Schlichting, Boundary-Layer Theory, 7th Ed. McGraw-Hill, 1987 (on reserve at library)
R. Fox and A . MacDonald, *Introduction to Fluid Mechanics*, Wiley (on reserve at library)

Course Bulletin Description

Brief review of the fundamental conservation and constitutive equations, exact solutions of the viscous Navier-Stokes equations, similarity solutions, boundary layer theory; creeping flows, flow in Hele-Shaw cells, lubrication theory, thin shear layer approximations, jets and wakes, hydrodynamic instability and transition to turbulence, Reynolds-averaged Navier-Stokes equations.

Grading

Homework and projects	30%
Midterm	35%
Final	35%

Homework policy

Homework, which will be assigned in class and noted on the course web page is due at the beginning of the designated class period (unless otherwise noted.) All homework will be graded and returned. The top of the first page of the homework should have: your name and the course number. Every page should have the problem number on the top right corner. There should be no frayed edges and multiple pages must be stapled. You should briefly restate the problem (some even make a photo copy and tape the problem statement to the page). Give a sketch if helpful. List the basic assumptions. Give all necessary analysis. If asked to plot something, you must create a computer generated graph with appropriate axis labels and legend. Place a box around the final answer. Correct units should accompany all numerical answers.

Honest policy: Adherence to the Student Academic Code of Conduct is expected. I encourage you to freely discuss the homework amongst one another as you formulate your solutions individually. *Your* written work should represent *your* understanding of the problem.

In practice this means that copying (in whole or in part) another student's homework, exam, computer program, or paper is not permitted. If you choose to discuss your work with a colleague, it should be a discussion in which one teaches another or both work to a mutual understanding. As a counter-example, it is not acceptable to give a friend your homework five minutes before class so that your friend can copy your work. I also consider it unacceptable to copy work from a student who was in the class a previous year. In your written reports, be careful to correctly use quotation marks for words that did not originate with you. Also, be sure to properly cite all sources you used. As is done in the scientific literature, you should *briefly* acknowledge in writing any significant discussion or interactions you had regarding the work you submit. As a general principle, I do not accept the justification that you were not sure of my intentions. If you feel you may be in an ethical gray area, then you should consult with me *before* acting.

Computer Usage:

Some homeworks/projects will require the use of MATLAB or other programming language such as C or Fortran, EXCEL, Word

Course Topics

Syllabus

1. Fluid properties/ Boundary conditions (1 lecture)
2. Governing equations (comp./visc.)
    1. Differential and CV
    2. Mass, momentum, energy
    3. Stress tensor
    4. Alternate forms of gov. equations
    5. Nondimensional parameters
    6. Vorticity Eq.
3. Newtonian Flows
    1. Couette
    2. Poiseuille
    3. Unsteady duct *
    4. Wind driven'
    5. Similarity Solutions
    6. Creeping flows
4. Boundary Layers
    1. Laminar
        1. 2D similarity
        2. Free-shear
        3. Integral methods
        4. Duct inlet
        5. 3D
    2. Stability
    3. Turbulent
        1. Reynolds eq.
        2. In pipes
        3. On flat-plate