Instructor: Michael Sprague, Assistant Professor, School of Natural Sciences
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Lecture Time & Location: MW 10:00 am – 11:15 pm, COB 272

Office Hours: Monday 3:00 - 3:50, Wednesday 9:00–10:00 (S&E 332)
Students are welcome to e-mail, call, or just stop by my office. I am rarely on campus on Tuesdays & Thursdays, but can usually be reached via email or cell phone.

Course Webpage: Resources and homework assignments are located at

http://faculty.ucmerced.edu/msprague/math292_s2010.html

Prerequisites: Graduate standing is required. Students should have a solid background in single and multivariable calculus, ordinary-differential equations, and some knowledge of partial-differential equations. No previous course-work in fluid dynamics is expected.

Course Units: Four

Catalog Description (for Math 292 Special Topics): Treatment of a special topic or theme in applied mathematics at the graduate level. May be repeated for credit in a different subject area

Learning Objectives: Understand the derivation from first principles of the governing equations for fluid motion and understand the various limiting cases. Understand the physical mechanisms of fluid flow and the relationship to relevant mathematical models. Employ analytical solution methods for simple systems, and recognize the limitations of such methods.

Learning Outcomes:

- Describe the method and assumptions in the derivation of the governing equations for fluid motion.
- Apply problem-appropriate physical assumptions to simplify the governing equations.
- Using techniques for solving differential equations, find solutions for simple systems.

Potential Course Topics: Below are listed some potential topics that we will cover as time permits in support of the above learning outcomes and objectives.

- Review of vector and tensor analysis
- Derivation of governing equations
- Viscous flow
- Potential flow
- Surface tension
- Boundary layers
- Rotating flows
- Instability and transition to turbulence
- Introduction to computational fluid dynamics

Textbooks: There is no required textbook for this course. However, I will refer to the following two books; both are available in paperback.

D. J. Acheson, *Elementary Fluid Dynamics*, Oxford University Press, 1990.

G. K. Batchelor, *An Introduction to Fluid Dynamics*, Cambridge University Press, 2000.

Assessment & Scoring: The course grade is based on homework (65%), class participation (10%), and a final exam (25%). The final exam will be oral and/or written; details will be announced later.

Each homework assignment will be scored on a scale of 100 points. Problems will be graded according to the rubric described below. Letter grades will be given in the **approximate** framework: A: 90-100%, B: 80–90%, C: 70–80%, D: 60–70%. Homework will be assigned every one or two weeks. Late homework will not be accepted.

Grading Rubric: Homework and exam problems will be scored with the following rubric:

5–excellent understanding: "He or she's got it!" The work indicates that the student clearly understands how to solve the problem. Typically, one can tell a '5' within ten seconds of looking at it.

4–good understanding: The work indicates that the student has the basic idea, but messed up on one thing. The student understands the main concepts and problem-solving techniques completely or almost completely, but still has some minor, yet nontrivial gaps, in his or her reasoning.

3–fair understanding: The work indicates that the student is partly getting it, but missing some important stuff. The student is not completely lost, but does not really get it, either. A "3" answer often looks like the student was going along fine for a while, but then branched off in some weird direction, or just did not know how to handle a crucial step. Part of the answer may look like it was done more by rote than by true understanding.

2–poor understanding: Everything is done by rote; the work implies that the student does not understand what he or she is doing. A "2" answer is not completely off base, but it reflects reasoning done almost entirely by rote memory or by "pattern matching" to an earlier problem, or maybe the student goes off in some direction that's not entirely crazy, but doesn't work.

1– no understanding: The work implies that the student did not get it at all. The student may have jotted down some appropriate formulas and diagrams, but did not know what to do with them, or the student did something completely off base.

0–wrote hardly anything: The student left the problem blank. Even blatantly wrong or incomplete answers get a 1. A 0 is reserved for blank or almost-blank pages.

Homework Requirements: Homework presentation is expected to be of high quality in content, and presentation. You are encouraged to work in groups. However, **all work turned in must be your own.** You must **list explicitly any outside sources employed** (*e.g.* websites, *Mathematica*, books, etc.) for each problem you solve. This does not mean that you are allowed to copy a solution should you find it posted elsewhere (see Academic integrity below). Late homework will not be accepted.

Computers, Software & Programs: You may use a calculator (graphing or otherwise) or other computational tool (*e.g.*, Mathematica, Maple, Matlab, etc) to aid in your completion of homework assignments.

Dropping the Course: Please see the UC Merced *General Catalog* for more details.

Special Accommodations: If you qualify for accommodations because of a disability, please submit a letter from Disability Services to the instructor in a timely manner so that your needs may be addressed. Student Affairs determines accommodations based on documented disabilities. I will make every effort to accommodate all students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Please speak with me during the first week of classes regarding any potential academic adjustments or accommodations that may arise due to religious beliefs during this term.

Academic Integrity: Academic integrity is the foundation of an academic community and without it none of the educational or research goals of the university can be achieved. All members of the university community are responsible for its academic integrity. Existing policies forbid cheating on examinations, plagiarism and other forms of academic dishonesty. The current policies for UC Merced are described in the Academic Honesty Policy. Go to http://studentlife.ucmerced.edu/ and look under "Student Judicial Affairs."