SUNY-Geneseo
Department of Physics and Astronomy
Class: MW 3:30pm, Greene 234
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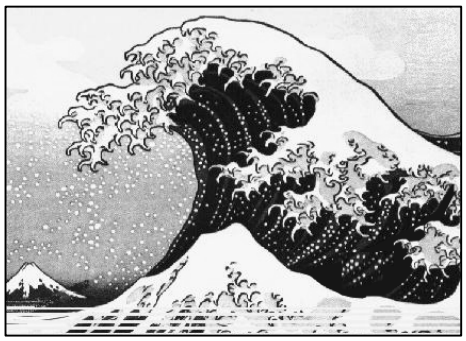
Fluid Mechanics

(Phys 314)

Spring 2005



What am I doing here? The behavior of fluids is critical to a wide variety of everyday applications. To understand why airplanes fly, or propellers push, or curveballs turn, or why the wind blows, we need to first understand the fundamental behaviors of fluids. We'll start by defining "fluid", and contrasting fluids with solids. We'll use Newton's Second Law ($\Sigma F = ma$) to predict the motion of fluids, and we'll use a few ideas from thermodynamics, too. Also, we'll play some clever algebraic tricks with units ("Dimensional Analysis") to help us simplify complicated problems to a more manageable level. By the end of the class, you should be adept at solving problems using the following ideas:

> the continuum, fluid fields, streamlines, density, viscosity, control volumes and control masses, pressure, normal and shear stress, buoyancy, conservation principles (Bernoulli's equation, Navier-Stokes), hydraulic jumps, potential flows, dimensional analysis, boundary layers, lift, drag, vorticity, and circulation.

The textbook for this class, *Fluid Mechanics*, by Frank White (5^{th} edition, McGraw Hill, 1999) is pretty user-friendly. Since there are too many subtopics to cover in a single semester, we will not cover all of the topics in the text. Also, we will not cover all of the topics in the exact same order as the text.

How will I be graded? Your grade will be determined by:

Weekly Assignments and Quizzes:		25%
Project:		10%
Semester Exams:	$2 \times 20\% =$	40%
Final Exam:		25%
		100%

What's this about a project? Midway through the semester, you will choose a project idea based on one or more of the topics we've studied. Although I will provide some suggestions for projects, you are permitted to develop your own idea, subject to my approval. Your projects may be theoretically or experimentally based. The projects may be individual or group efforts, and should be open-ended (i.e., you will not be working towards a single "correct" answer).

When are the tests? Here is a tentative schedule of exams. Exams 1 and 2 are currently scheduled as "in class" exams. If the entire class (including Dr. Pogo) agrees, an exam time, date, or length can be changed (to a two hour evening exam, for example). Such changes will not affect the exam questions.

Exam #1: Wednesday, March 2, 2005 (chapters 1 through 3 of *White*)
Exam #2: Wednesday, April 13, 2005 (chapters 3, 4, 6b and 8 of *White*)
Exam #3 (final): Monday, May 6, 2005, 3:30pm – 6:30pm (chapters 1 through 8 of *White*)

Homework Rules

The following rules exist for my convenience in grading, and are non-negotiable. Violation of these rules will negatively affect your course grade.

1) Use $8\frac{1}{2} \times 11$ inch paper. Do not use any spiral ring paper. Use only one side of each sheet.
2) Put your name on the top of every page. Put the assignment number on the top of the first page (e.g., "Fluids, Assignment #3, etc.). Clearly indicate the problem number that you are working on (e.g., problem 3-17).
3) **Staple** all your sheets together. Paper-clips are not permitted. Pages with torn corners in place of a staple will be returned unexamined, with a grade of zero.
4) Work must progress linearly down the page. If your solution initially meanders around the page, I expect you to **recopy your solutions**.
5) Use a pencil. Erase errors instead of blotching them out.
6) Draw and use Free Body diagrams as appropriate for all problems. Define and use coordinate systems. Specify your choice of "free body". Label your forces.
7) **Define your symbols**, and **use subscripts**. Not all velocities can be called "*V*", and not all pressures can be called "*P*". Every symbol must be unique and clearly defined. Make a list or table of relevant symbols and their values when this will help me to understand your solution.
8) **Use words** and/or pictures to clarify your method of solution and your symbol definitions.
9) Write all fundamental formulas and do as much work as possible symbolically before making any numeric substitutions. When you do plug in numeric values, show them explicitly, and **include units**.
10) Don't blindly trust your calculators. Do not submit nonsensical results (e.g., a negative pressure, or a velocity in excess of *c*). Don't use more than 4 sig figs in your final answer. **Don't round any answers until you are ready to write your final answer**. Box your answers, and include the symbol and units:

$$\boxed{P_{\text{point 4}} = 1560 \text{ Pa}}$$

11) When you discuss problems with each other, you should not discuss the details of any solution. Even if you work with someone else, you must arrive at your own answers for each problem. You may not copy any portion of another student's written work. If you are stuck, talk to me instead.