



**Jack A. Puleo, Ph.D.**  
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**Web page with information and assignments**  
**<http://www.coastal.udel.edu/faculty/Jack-Puleo.html>**  
**and click on Courses**

**CIEG 305 FLUID MECHANICS (3 Credits)**  
**Fall 2009**

**Class: Sharp Lab (SHL) 131**

**MWF 12:20 – 1:10**

<b>Instructor:</b> Dr. Jack Puleo	<b>Teaching Assistant:</b> Tim Sliwinski
Ocean Engineering Lab 203 (behind Penny Hall)	Ocean Engineering Lab (behind Penny Hall)
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<b>Web page with information and assignments</b> <a href="http://www.coastal.udel.edu/faculty/Jack-Puleo.html">http://www.coastal.udel.edu/faculty/Jack-Puleo.html</a>	

**Required Text:** Fluid Mechanics, 6<sup>th</sup> Edition by Frank M. White, McGraw-Hill

**Course Description:** Fluid mechanics utilizes knowledge from mathematics, physics, statics and dynamics to analyze problems involving the fluid medium. This may be the most difficult course you'll take in your Civil Engineering program because it does not directly build off of a previous course. In general, we will discuss fluid properties, hydrostatic pressure, pressure on surfaces, conservative equations of mass, momentum and energy and pipe flow in relation to real world engineering problems.

**Course Objectives:**

When you complete this course, you will be able to:

- a. Define a fluid and the properties that are associated with it.
- b. Describe hydrostatic pressure and how it relates to devices such as barometers.
- c. Calculate the force on linear and curved surfaces at an arbitrary orientation to a free surface.
- d. Determine stability of both floating and submerged bodies.
- e. Use mass, momentum and energy conservation equations to solve engineering fluid mechanics problems in a control volume.
- f. Describe how Bernoulli's equation works and what the drawbacks of the simplified Bernoulli equation are.
- g. Interpret the individual terms in the differential forms of the mass and momentum equations.
- h. Differentiate between a streamline, pathline and streakline.
- i. Identify the rotationality of a flow and determine if potential flow solutions are applicable.
- j. Explain the concept of similitude.

- k. Utilize dimensional analysis to create the appropriate conditions for a scale model.
- l. Solve pipe flow problems incorporating head loss.

**What we will cover (OUTLINE):**

- Chapter 1: Introduction
- Chapter 2: Pressure distribution in a fluid
- Chapter 3: Integral relations for a control volume
- Chapter 4: Differential relations for a fluid particle (parts of Chapter 8)
- Chapter 5: Dimensional analysis and similitude
- Chapter 6: Viscous Flow in ducts

**GRADING**

I believe you learn more by doing  
 “I hear, I forget. I see, I remember. I do, I understand.”

Exam 1:	20%
Exam 2:	20%
Final exam:	30%
Homework:	30%

Grades are based on a standard 90-80-70 etc scale (Why? So you will always know where you are with respect to your grade.). I do reserve the right to nudge an individual’s grade upward slightly (never downward) if trends of improvement over the course occur. Also, your in-class participation can cause a grade to be nudged upward (never downward).

**Exams:** Calculators and one-half of one side of a sheet of paper (turn in with exam).

Will consist of 2 sections

- 1) Short answer, true false, multiple choice to see if you get the general concepts. I call this “Conversational Engineering” (probably only 20% of exam).
- 2) Several problems to see if you can apply those concepts.

**Homework:** Assigned every Friday and due the following Friday at beginning of class. If you can’t make class, you should have a friend bring it in for you or call me (beforehand) to arrange something. Late homework will not generally be accepted unless extenuating circumstances arise.

Homework will be returned in a timely manner (Monday) giving you a quick assessment.

## **COURSE POLICIES**

- a. Environment: The course will consist of an energetic, non-threatening environment where students will be called upon frequently. Questions and discussion are encouraged. That is how you learn. Physical demos and real-life examples are often used.
- b. Attendance: You are responsible for material presented in class. You will do poorly in this class if you do not attend. Make every effort to be here.
- c. Classroom Procedures:
  1. Please come to class on time. Late arrivals disrupt the class.
  2. I will make every effort to have Learning Objectives for the day posted. It is my intention to make sure you will be able to meet those objectives by the end of class.
- d. Neatness: Anything you turn in is a reflection of you. Please make sure it is neat. Sloppy work will be returned ungraded. The forward thinking student realizes that these course notes and homework should be organized and retained for future use.
- e. Study Groups: “Safety in Numbers”. I encourage the use of study groups for homework and exams. I do not mind if you do homework assignments together as long as each person turns in their own work. Carbon copies of an assignment will garner suspicion.
- f. **Additional Instruction: While I have numerous research agendas ongoing, I highly value the teaching process and am committed to you learning the subject matter.**
  1. **I will hold a homework study group once per week (likely Wednesday) at a time to be determined. All I ask is that you come prepared, having already tried the problems. This will be an interactive environment.**
  2. **My office door is nearly always open. If you have trouble with a concept, come by. In the unlikely event that I have to turn you away (e.g. proposal deadline), I will schedule a time to meet with you. Please also use the TA for this course.**
  3. **I will hold midterm exam study groups reviewing the material that will be covered (TBD).**
- g. Interruptions: Please turn off your cell phones. I also discourage use of laptops during lecture (if you write it down, it stays with you longer). If your phone rings, I get to answer it.
- h. Lunch Club: PIZZA! I buy lunch for students who score 90 or better on both midterms.

## ACADEMIC HONESTY

Cheating is not tolerated! All students must be honest and forthright in their academic studies. To falsify the results of one's research, to steal the words or ideas of another, to cheat on an assignment, or to allow or assist another to commit these acts corrupts the educational process. Students are expected to do their own work and neither give nor receive unauthorized assistance. Any violation of this standard must be reported to the Office of Judicial Affairs.

## SYLLABUS (TENTATIVE)

Week 1 (9-2, 9-4)	Intro, Fluids, Fluid properties,
Week 2 (9-9, 9-11)	Fluid properties, Flow patterns
Week 3 (9-14, 9-16, 9-18)	More definitions, Fluid statics, hydrostatic pressure
Week 4 (9-21, 9-23, 9-25)	Forces on surfaces
Week 5 (9-28, 9-30, 10-2)	Buoyancy, Stability, rigid body motion
Week 6 (10-5, 10-7, 10-9)	EXAM 1, Reynolds transport theorem, control volume analysis
Week 7 (10-12, 10-14, 10-16)	Conservation of mass, linear momentum
Week 8 (10-19, 10-21, 10-23)	Angular momentum, energy eqn
Week 9 (10-26, 10-28, 10-30)	Bernoulli eqn
Week 10 (11-2, 11-4, 11-6)	Exam 2, differential analysis conservation of mass, momentum
Week 11 (11-9, 11-11, 11-13)	Surface forces, stress tensor
Week 12 (11-16, 11-18, 11-20)	Newton's law of viscosity, Navier Stokes eqns. Viscous flow
Week 13 (11-23)	Dimensional analysis
Week 14 (11-30, 12-2, 12-4)	Pipe flow, friction factors, open channel flow
Week 15 (12-7, 12-9)	Other topics, review
Week 16	FINAL EXAM Time and Location TBA