CE 360 FLUID MECHANICS (section 001)
Monday, Wednesday, Friday 9:05-9:55 am in 220 Hammond

INSTRUCTOR: Dr. Sarah Godsey
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OFFICE HOURS: Dr. Godsey's: MONDAYS 10 am-12 pm, WEDNESDAYS 10 am- 12 pm, or by appointment

TA: Emily Bernzott (edb5111@psu.edu) Office Hours: TUESDAYS 9-11am, WEDNESDAYS 11am-1pm, and THURSDAYS 1-3pm in Sackett Rm. 406 – if the door is locked, knock on it; this room accommodates many CEE graduate students.

REQUIRED TEXT: Young et al., *A Brief Introduction to Fluid Mechanics*, 4th Edition, John Wiley & Sons, Inc., New York, NY, 2007.

GRADING:		
	Participation	10% (In-Class Exercises)
	Homework	30%
	Virtual Labs	10%
	Bi-Weekly Quizzes	50%

Final grades will be based on the weighted average specified above and assigned as follows:

- A ≥ 94%
- 94 > A- ≥ 90%
- 90 > B+ ≥ 87%
- 87 > B ≥ 84%
- 84 > B- ≥ 80%

- 80 > C+ ≥ 76%
- 76 > C ≥ 70%
- 70 > D ≥ 60%
- 60 > F

I reserve the right to adjust your grades. Your grade will only improve if adjustments are necessary. Feel free to contact me during office hours or by appointment if you have grade-related questions or concerns. Grade reporting will be conducted through ANGEL.

COURSE GOALS:
Enable you to understand and apply the fundamental principles governing incompressible fluids to the design of engineering systems. Fluids surround and affect everything in the physical world, consequently every major project you will be participating in as an engineer requires a sound understanding of the material covered in this course. This course represents a stepping stone in your professional development; it is intended to aid you in developing the skills you will need for systematic decomposition and solution of real-world problems.

ABET EDUCATIONAL OBJECTIVES:
- Gain a solid understanding of the basic principles of mathematics, science, and engineering.
- Be able to apply this understanding to advance your technical competency in Civil Engineering
- Be able to use the techniques, skills, and modern engineering tools learned in this course for practice in Civil Engineering and/or graduate education.

ABET EDUCATIONAL OUTCOMES:
- An ability to apply your knowledge of mathematics, science, and engineering.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

PREREQUISITES
The prerequisite for this course is EMCH 212 (Dynamics). If your PSU record does not reflect that you have passed this course, please consult the instructor prior to the drop date (Jan 19).

ON-LINE CLASS MANAGEMENT:
All course emails and web postings will be made using the ANGEL course management software. You are responsible to regularly login (**https://cms.psu.edu/default.asp**) to check course announcements, download in-class example solutions, and access posted homework solutions. *Incomplete* lecture materials will be posted online 24 hours prior to each class that may aid your in-class notetaking. It is your responsibility to print copies, if you choose.

IN-CLASS PARTICIPATION:
Please bring your text, notes, a calculator, and scrap paper to each class. You will be participating in the solution and discussion of in-class exercise problems. You will work alone or in small groups while solving these problems. Each group will hand in their attempt to solve the problem with each member's signature on the paper. Simply attempting the solution will result in full participation credit for the day. These in-class exercises will require that you **complete the assigned readings** prior to the beginning of each class.
Note that participation counts for 10% of your grade. You are encouraged to keep your notes/materials organized.

HOMEWORK:
Selected homework problems will be assigned related to the material in each lecture. Homework will be assigned bi-weekly and is due at the on the Friday of the subsequent week. Most problems will be from the text, but interactive problems on ANGEL may be posted as appropriate. Please note the following important points:
1. The primary role of these problems is to reinforce concepts learned in class. They are intended to provide practice in setting up and solving engineering problems.
2. Assignments are due at the **beginning of class**. Please drop them off before class begins.
3. Your lowest homework grade will be dropped at the end of the semester. This should accommodate any unexpected absences from class. As such, **no late submittals** will be accepted.
4. You are encouraged to work with other students in class, but the work you submit must be your own. There is a fine line between collaboration and academic misconduct, please do not cross it. Note that referring to or copying solutions from previous semester or the internet will be considered academic misconduct and treated accordingly. Please include the names of all of your group members on your submitted assignment.
5. Please submit your assignments in accordance with the following requirements:
    a. Work on 8.5x11-inch paper, on one side only. Feel free to recycle paper.
    b. Include **your name**(s) on each page of **stapled** solutions, with all pages numbered
    c. For each problem, include a *legible step-by-step* presentation of the solutions, including **problem diagrams**. Clearly indicate given information, unknowns, any assumptions that you make, and **box your final answer** presented in the **proper units**.

Solutions will be made available (on the class ANGEL site) after your assignments have been collected.

VIRTUAL LABS:
To provide more practical experience with some of the concepts in this course, we are developing *virtual* laboratory experiments. These will be provided via ANGEL. You are expected to complete these virtual laboratory exercises individually. Together they represent 10% of your final grade.

QUIZZES:

This class has no mid-term or final exams. Quizzes will be given in class on the dates listed below (every 2 weeks, on Fridays). You will be allowed one-side of a 3"x5" note card as a crib sheet for each quiz. Your grade in this class will not include your worst quiz grade. Make-up quizzes will <u>not</u> be given. In extreme cases, a quiz grade will be replaced by the average of your grades on the remaining quizzes (proof of illness or emergency will be required). For quizzes, you must work in pencil. You are allowed to bring in a calculator (in most cases the simplest of calculators will suffice), but no other cell phones, smart phones, PDAs or any other electronics will be allowed.

EXTRA CREDIT:

NOTE - you may submit one of the following with each homework assignment, but not both…

1) *Fluids in the News*: This course introduces you to the importance of fluids, with an emphasis on the physical and engineering aspects of fluid mechanics. You can earn an additional 10% on each of the 7 homework assignments, if you find examples in newspapers, magazines, or the internet of real-world problems where the topics covered in this course play a vital role. To earn this credit, you will need to submit a 1-paragraph (<300 words), well written synopsis with your homework assignment that provides:
   - Summary of the issue (in your own words)
   - Brief discussion of how the problem relates to this class (what principles covered in class are important in solving the problem?)
   - Complete reference for where you found the story
   - You must turn these in prior to or with each homework assignment throughout the semester (i.e., you have a 2-week window to generate each one). Please keep them separate from your homework assignments, however (i.e., do not staple them to your homework).
   - NOTE that your source MUST be a reputable source of factual information. Blogs, case studies from individuals that are not 'officially' published or peer-reviewed are NOT acceptable.

2) *Fluids in Current Research*: Similar to *Fluids in the News*, you can earn an additional 10% on each of the 7 homework assignments if you attend and turn in your report of a seminar on campus that is related to fluid mechanics. I will announce such seminars in class. If you choose to attend one that I have not announced, please contact me first to approve it. You will need to submit a 2 paragraph report where 1 paragraph is a short summary of the seminar and the 2nd paragraph discusses how the seminar content relates to this class.

3) *Essay Competition*: You are encouraged to develop your writing skills and broaden your perspective on the "beauty" of fluid mechanics. To participate in this competition you must write a 5-page essay that addresses the following topic:

   How have advances in our knowledge of fluid mechanics enhanced our modern lives?

   Your essay needs to be researched with citations, well written, and **<u>original</u>**. Furthermore, it should be informative and fun to read. The essays must be of very high quality to be considered in the competition. Students with top rated essays will receive 5 points added to their final grade. Any student who submits a high quality essay will receive a minimum of 2 points added to their final grade. The best essays will be published on the web.

   <u>Letters of Commitment are due January 26, 2011 (simply email me stating that you will participate).</u>
   <u>Essays are due Monday, April 4, 2011 by 5pm with no exceptions.</u>

MISC. BUSINESS

Please respect your fellow students by arriving on time, keeping side-conversations to a minimum, focusing your attention on the lecture and problem solving, not packing your things to leave before class is over, and by turning cell phone ringers off and keeping phones put away during class.

If you find yourself having difficulty early in the semester please see me ASAP. I enjoy helping students understand the material. Often times a few conversations to help explain the material in another way is all that students need to be highly successful in this course.

Feel free to email me with questions related to lecture, homework, or in class exercises. Please do understand that I will attempt to reply in a reasonable amount of time, but that the reply may not be immediate. Also, for help with solving problems office hours are highly encouraged (as opposed to emailed questions). The learning process in this course is centered around working to solve problems – explanations via email are difficult and can lead to more confusion than help.

Because there is no midterm or final, it is vital to keep on top of the material as you will be responsible for knowing it for both homeworks and quizzes throughout the course. Concepts build upon one another, making it easy to get behind. Additional strategies that have helped students in the past include (1) reading relevant sections in the text both before and after lecture, (2) reviewing homework problems that are not assigned to practice applying concepts to different scenarios, and (3) reviewing problems in the student study guide.

ACADEMIC INTEGRITY

The College of Engineering' statement on academic integrity is available at http://www.engr.psu.edu/CurrentStudents/acadinteg.aspx. Please review this information as it provides details on what constitutes a violation of academic integrity, how violations are dealt with, and penalties for violations.

CE360 COURSE SCHEDULE (subject to change, if topics require more lecture time)

Lec. #	Week/Date	Topic	Reading	Assignments
1	1M – Jan. 10	Course Introduction	None	
2	1W – Jan. 12	Dimensions, Physical Properties	1.1-1.5	
3	1F – Jan. 14	Viscosity, Surface Tension	1.6-1.9	
	2M – Jan. 17	**Holiday-no class**		
4	2W –Jan. 19	Fluid Statics – Overview & Hydrostatic Pressure, *also *drop deadline**	2.1-2.4	
5	2F – Jan. 21	Fluid Statics - Pressure Variations	2.1-2.4	Homework #1 due
6	3M –Jan. 24	Fluid Statics – Manometry	2.5-2.7	
7	3W – Jan. 26	Fluid Statics – Forces on plane surfaces I	2.8	**Deadline for Essay Commitment**
8	3F – Jan. 28	Fluid Statics – Plane Surfaces II	2.8	Quiz #1 (Lect. 1-6)
9	4M –Jan. 31	Fluid Statics – Layered fluids, pressure prisms	2.9	
10	4W – Feb. 2	Fluid Statics – Forces on curved surfaces	2.10	
11	4F – Feb. 4	Fluid Statics – Buoyancy, stability	2.11	Homework #2 due
12	5M –Feb. 7	Fluid Statics – rigid body motion; Review of Hydrostatics	2.11-2.12	
13	5W –Feb. 9	Fluids in Motion – Newton's 2nd law, acceleration along/normal to streamlines I	3.1-3.3	
14	5F –Feb. 11	Fluids in Motion – acceleration along/normal to streamlines II	3.1-3.3	Quiz #2 (Lect. 7-12)
15	6M –Feb. 14	Fluids in Motion – Bernoulli Equation I	3.4-3.6	
16	6W – Feb. 16	Fluids in Motion – Bernoulli Equation II	3.6	
17	6F –Feb. 18	Fluids in Motion – Bernoulli Equation III	3.6	Homework #3 due
18	7M – Feb. 21	Fluids in Motion – Energy & Hydraulic Grade Lines	3.7-3.8	
19	7W– Feb. 23	Fluids in Motion –Energy Equation	5.3	
20	7F –Feb. 25	Fluids in Motion - Energy Equation examples	5.3	Quiz #3 (Lect. 13-18)
21	8M –Feb. 28	Review of Bernoulli & Energy Equations	Ch. 3, 5.3	
22	8W –Mar. 2	Fluid Kinematics –Control Volume Representation, Velocity & Acceleration	4.1-4.3	
23	8F – Mar. 4	Fluid Kinematics – Reynolds Transport Theorem	4.4	Homework #4 due

Mar. 6-12, no lectures – Spring Break – Enjoy…			
24	9M – Mar. 14	Fluid Kinematics – Conservation of Mass	4.3, 5.1	
25	9W –Mar. 16	Fluid Kinematics – Conservation of Mass and Linear Momentum	5.1-5.2	
26	9F - Mar. 18	Fluid Kinematics - Linear Momentum	5.2	Quiz #4 (Lect. 19-24)
27	10M - Mar. 21	Fluid Kinematics – Angular Momentum	5.3	
28	10W - Mar. 23	Fluid Kinematics – Angular Momentum II	5.3	
29	10F - Mar. 25	Review of Fluids in Motion and Kinematics	Ch. 4, 5	Homework #5 due
30	11M - Mar. 28	Dimensional Analysis – Buckingham Pi Theorem	7.1-7.3	Virtual Lab #1 due
31	11W - Mar. 30	Dimensional Analysis – Common Dimensionless Groups	7.4-7.7	
32	11F - Apr. 1	Dimensional Analysis – Modeling & Similitude	7.8-7.9	Quiz #5 (Lect. 25-30)
33	12M - Apr. 4	Viscous Flow, Boundary Layers I	9.1-9.2	***Essays Due***
34	12W - Apr. 6	Viscous Flow, Boundary Layers II	9.1-9.2	
35	12F - Apr. 8	Viscous flow in pipes ***ALSO Late Drop Deadline***	8.1-8.2	Homework #6 due
36	13M - Apr. 11	Laminar and Turbulent Flow in Pipes	8.2-8.3	Virtual Lab #2 due
37	13W - Apr. 14	Turbulent Flow in Pipes	8.3-8.4	
38	13F - Apr. 16	Turbulent Flow in Pipes, Moody Diagram	8.3-8.4	Quiz #6 (Lect. 31-36)
39	14M - Apr. 18	Pipe flow losses, multi-flow pipe systems, pump flow rate measurement	8.5-8.6	
40	14W - Apr. 20	Open Channel Flow – characteristics, surface waves	10.1-10.2	
41	14F - Apr. 22	Open Channel Flow – surface waves	10.2	Homework #7 due
42	15M - Apr. 25	Open Channel Flow – specific energy I	10.3	
43	15W - Apr. 27	Open Channel Flow – specific energy II	10.3	
44	15F - Apr. 29	Winning essays to be read by authors…		Quiz #7 (Lect. 37-43)