CE 360 FLUID MECHANICS
Spring 2013
Monday, Wednesday, and Friday 9:05-9:55 am in 220 Hammond Building

INSTRUCTOR: Dr. Alfonso Mejia
OFFICE: 215B Sackett Building
TELEPHONE: 865-0639
EMAIL: amejia@engr.psu.edu
OFFICE HOURS: Dr. Mejia's: MONDAYS 2:30 pm-4:30 pm, WEDNESDAYS 2:30 pm-4:30 pm, or by appointment

TA: Cidney Jones (cjs1169@psu.edu). Office hours: **Tuesdays 1 pm-3 pm** and **Thursdays 1 pm-3 pm** on the 4th Floor of Sackett Building. Office hours will be held at the chalk board on the northwest side of the studio, her desk is in the cluster nearest the chalkboard.

REQUIRED TEXT: Young et al., *A Brief Introduction to Fluid Mechanics*, 5th Edition, John Wiley & Sons, Inc., New York, NY, 2011.

Guided notes for this class will be made available through ANGEL.

GRADING:		
	Participation	10% (In-Class Exercises)
	Homework	40%
	Bi-Weekly Quizzes	50%

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

- A = 94-100%
- A- = 90-93%
- B+ = 87-89%
- B = 84-86%
- B- = 80-83%
- C+ = 76-79%
- C = 70-75%
- D = 60-69%
- F < 60%

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.

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.

IN-CLASS PARTICIPATION:

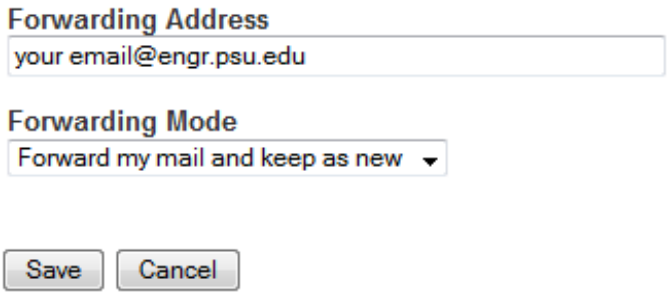
Please bring your text, notes, a calculator, a few good pieces of paper, and scrap paper to each class. *You will be participating in the solution and discussion of in-class exercise problems*. You will work alone or in small groups while solving these problems. Each group will hand in their attempt 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.*

ON-LINE CLASS PARTICIPATION:

All course emails and web postings will be made using the ANGEL course management software. You will need to regularly login (**https://cms.psu.edu/default.asp**) to check course announcements, download in-class example solutions, and access posted homework solutions.

Important: When you 1st login into the system you must configure "My Settings" to forward course emails to your primary email account as follows:

Step 1: Login into system
Step 2: Click "Preferences"
Step 3: Click "System Settings"
Step 4: Type your PSU Email under "Forwarding Address" and set "Forwarding Mode" as shown below:



Step 5: Click "Save". You now should receive all course announcements in your primary email account as well as your ANGEL account.

HOMEWORK:

Homework will be assigned bi-weekly and is due at the **beginning of class** on the Friday of the subsequent week. Late homework **will not** be accepted. Feel free to work on the assignments in groups of 2 or 3. If you are doing group work, each group member needs to submit a homework.

Each assignment requires:

- Your name(s) on each page of **stapled** solutions.
- A legible step-by-step presentation (**in pencil**) of the solutions (**include problem diagrams**).
- Boxed answers presented in proper units.

Solutions will be made available after your assignments have been collected.

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 not 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, blackberries or any other electronics will be allowed*.

EXTRA CREDIT:

(1) This course introduces you to the importance of fluids. I will increase your score on each homework assignment by 10% of the total points possible, 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. Submit a 1-paragraph (<300 words), well written synopsis that provides:
- A summary of the problem (in your own words).
- A brief discussion of how the problem relates to this class (what principles covered in class are important in solving the problem?).
- A reference for where you found the story.

(2) *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 has human civilization advanced because of our knowledge of fluid mechanics?

Your essay needs to be researched with citations, well written, and **original**. 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 3 points added to their final grade.

Letters of Commitment are due **February 1, 2013** (simply email me stating that you will participate).
Essays are due Friday, **April 5, 2013** (hard copy or via email as a .doc or .pdf file) by 5 pm with no exceptions.

ACADEMIC INTEGRITY

The College of Engineering' statement on academic integrity is available at http://www.engr.psu.edu/FacultyStaff/AcademicIntegrity.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.

OFFICE FOR DISABILITY SERVICES

"Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) at 814-863-1807 (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at http://equity.psu.edu/ods/.

In order to receive consideration for course accommodations, you must contact ODS and provide documentation (see the documentation guidelines at http://equity.psu.edu/ods/guidelines/documentation-guidelines). If the documentation supports the need for academic adjustments, ODS will provide a letter identifying appropriate academic adjustments. Please share this letter and discuss the adjustments with your instructor as early in the course as possible. You must contact ODS and request academic adjustment letters at the beginning of each semester."

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

Lec. #	*Week/Date*	*Topic*	*Reading*	*Assignments*
1	1M – Jan. 7	Course Introduction	None	
2	1W – Jan. 9	Dimensions, Physical Properties	1.1-1.5	
3	1F – Jan. 11	Viscosity, Compressibility	1.6-1.7	
4	2M – Jan. 14	Vapor Pressure, Surface Tension	1.8-1.9	
5	2W – Jan. 16	Fluid Statics – Hydrostatic Distribution	2.1	
6	2F – Jan. 18	Fluid Statics – Pressure Fields	2.2-2.4	Homework #1 due
	3M – Jan. 21	NO CLASS – *Martin Luther King Day* ☺		
7	3W – Jan. 23	Fluid Statics – Manometry	2.5-2.7	
8	3F – Jan. 25	Fluid Statics – Forces on plane surfaces I	2.8	Quiz #1 (Lect. 1-7)
9	4M – Jan. 28	Fluid Statics – Forces on plane surfaces II	2.8	
10	4W – Jan. 30	Fluid Statics – Pressure prisms	2.9	
11	4F – Feb. 1	Fluid Statics – Pressures on curved surfaces ***ALSO – Deadline for Essay Commitment***	2.10	Homework #2 due
12	5M – Feb. 4	Fluid Statics – Buoyancy, stability	2.11	
13	5W – Feb. 6	Fluid Statics – Fluids w/rigid body motion	2.12	
14	5F – Feb. 8	Fluids in Motion – Newton's 2nd law	3.1	Quiz #2 (Lect. 8-13)
15	6M – Feb. 11	Fluids in Motion – acceleration along/normal to streamlines	3.2-3.3	
16	6W – Feb. 13	Fluids in Motion – Bernoulli's Equation I	3.4-3.5	
17	6F – Feb. 15	Fluids in Motion – Bernoulli's Equation II	3.6	Homework #3 due
18	7M – Feb. 18	Fluids in Motion – Energy & Hydraulic Grade Lines	3.7-3.8	
19	7W – Feb. 20	Fluids in Motion – Energy Equation I	5.3	
20	7F – Feb. 22	Fluids in Motion – Energy Equation II	5.3	Quiz #3 (Lect. 14-19)
21	8M – Feb. 25	Review of Bernoulli & Energy Equations	Ch. 3, 5.3	
22	8W – Feb. 27	Fluid Kinematics – Velocity and Acceleration	4.1-4.2	
23	8F – Mar. 1	Fluid Kinematics – Control Volume Representation	4.3	Homework #4 due
	Mar. 4-8	NO CLASS – *Spring Break* ☺		
24	9M – Mar. 11	Fluid Kinematics – Conservation of Mass	5.1	
25	9W – Mar. 13	Fluid Kinematics – Linear Momentum I	5.2	
26	9F – Mar. 15	Fluid Kinematics – Linear Momentum II	5.2	Quiz #4 (Lect. 20-25)
27	10M – Mar. 18	Fluid Kinematics – Angular Momentum I	5.2	
28	10W – Mar. 20	Fluid Kinematics – Angular Momentum II	5.2	
29	10F – Mar. 22	Review of Fluids in Motion and Kinematics	Ch. 4, 5	Homework #5 due
30	11M – Mar. 25	Dimensional Analysis – Buckingham Pi Theorem	7.1-7.3	
31	11W – Mar. 27	Dimensional Analysis – Modeling, Similitude	7.4-7.6	
32	11F – Mar. 29	Dimensional Analysis – Similitude	7.7-7.9	Quiz #5 (Lect. 26-31)
33	12M – Apr. 1	Viscous flow	9.1	
34	12W – Apr. 3	Boundary layers	9.2	
35	12F – Apr. 5	Viscous flow in pipes *****ALSO Late Drop Deadline***** ***ALSO Essay due by 5 pm***	8.1	Homework #6 due
36	13M – Apr. 8	Laminar flow in pipes	8.2	
37	13W – Apr. 10	Turbulent flow in pipes	8.3	
38	13F – Apr. 12	Dimensional analysis of pipe flow, Moody Diagram	8.4	Quiz #6 (Lect. 32-37)
39	14M – Apr. 15	Pipe flow losses, multi-flow pipe systems	8.5	
40	14W – Apr. 17	Pump flow rate measurement	8.6	
41	14F – Apr. 19	Open Channel Flow – characteristics, surface waves	10.1-10.2	Homework #7 due
42	15M – Apr. 22	Open Channel Flow – specific energy, uniform flow	10.3-10.4	
43	15W – Apr. 24	Open Channel Flow – rapidly varied flow	10.5-10.6	
44	15F – Apr. 26	No lecture/Winning essays		Quiz #7 (Lect. 38-43)