CE 462 Open Chanel Hydraulics

MWF 2:30-3:20p in 373 Willard

INSTRUCTOR: Dr. Michael Gooseff
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OFFICE HOURS: MONDAYS 3-5 pm, WEDNESDAYS 3-5 pm, or by appointment

REQUIRED TEXT: Mays, L. 2005. *Water Resources Engineering*, John Wiley and Sons.

PREREQUISITE REQUIREMENTS:
The prerequisite for this class is CE 360. You will be dropped from this course by the last day of the drop/add period (Wednesday, January 21) if your PSU record does not reflect that you have passed this requirement. Please contact me as soon as possible if you have any concerns regarding this requirement.

Open Channel Hydraulics draws heavily from Fluid Mechanics; we will use the conservation laws of classical mechanics to formulate and analyze a wide variety of interesting flow phenomena. Your familiarity with the material in CE 360 is assumed and will be essential to a satisfactory performance in CE 462. The review of this material during the first week of class will not be a replacement for this requirement.

GRADING:		
	Participation	10% (In-Class Exercises)
	Homework	30%
	Midterm Exams (2)	50%
	Final Project	10%

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 open channel hydraulics to the design of engineering systems. Natural and engineered hydraulic systems affect many aspects of the physical world, and modern human conveniences (e.g., water supplies). 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:

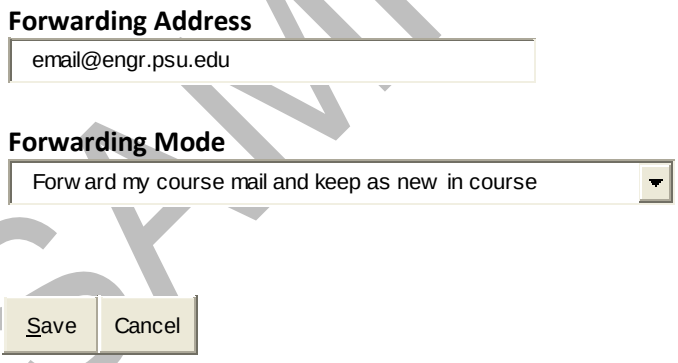
Please bring your text, notes, a calculator, and scrap paper to each class. You will be participating in the solution and discussion of in-class example problems. You are welcome to work alone or in small groups while solving these problems. Each group will hand in their attempt to solve the problem 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**) to check course announcements, download guided notes, and access homework assignments.

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 "My Settings"
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 regularly and is due at the **beginning of class** on the due date. Late homework **will not** be accepted. All homework is to be done in pencil on regular-sized (8.5"x11") paper. Please use only 1 side of the paper (though feel free to recycle paper). Present your homework NEATLY and in an ORGANIZED manner. Homework that is unclear will be returned ungraded.

Each assignment is complete only if it has the following:

- Your name on each page of **stapled** solutions
- Provide a clear problem outline
    - Given information – summarize the problem including labeled diagrams
    - Objective of the problem – state the unknown that is sought
    - Solution - A legible step-by-step presentation of the solutions
- Boxed answers are to be presented in proper units

The grading of each homework problem (or significant part of a mulit-part problem) will be:

- 3 points – Highest quality: assumptions and problem are well defined; problem solving method is clear and logical; the correct conceptual approach is used; a correct or nearly-correct final answer is presented. Minor mistakes (algebra, etc.) may result in full credit.
- 2 points – Satisfactory quality: problem statement is complete; the solution approach is generally correct, but may have inaccurate or missing minor elements; units are missing from your final answer; your final answer is not clearly identified.
- 1 point – Marginal quality: problem statement is incomplete and/or solving method is incomplete or not completely correct; work is illegible, unorganized or only marginally complete.
- 0 point – completely unacceptable. No substantive effort to solve the problem was made.

All homework assignments will have equal weight. Your lowest homework grade will be dropped. This is meant account for any potential issues that you may encounter during the semester (illness, etc.) that keeps you from doing your absolute best every week.

EXAMS:
This class has 2 mid-term exams (see schedule below). All exams will be closed-book, with necessary equations and numerical constants provided. While calculators may be used, cell phones, blackberries, and other electronic devices are strictly prohibited. Makeup exams will only be given in the event of a documented illness or a family emergency. Arrangements for an alternate exam need to be made, when possible, prior to the scheduled exam date. Alternate exams may be given orally, at my discretion.

EXTRA CREDIT:
You will have the opportunity to earn extra credit by writing 2 paragraphs on water-related seminars that occur on campus during the semester. One paragraph should be a summary of the lecture, the other should focus on how the seminar relates to this class. I will try to keep you appraised of these talks. For each lecture report that is well-written, you will receive 3 points added to your homework point total (before percentage is computed).

FINAL PROJECT:
The final four weeks of the semester will involve significant computer work (HEC-RAS, GIS, and HEC-GEORAS). You will have several small tutorial-style homework assignments during this period and one involved project, which builds upon these assignments. This final project will be in lieu of a final exam in the class.

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.

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

Note that "Ch. X" refers to a chapter or section of the Mays book, whereas "LY" refers to lecture supplemental reading material available online.

Lec. #	*Week/Date*	*Topic*	*Reading*	*Assignments*
1	1M – Jan. 12	Course Introduction, natural and engineering open channel flows	None	
2	1W – Jan. 14	Reynolds Transport Theorem, conservation laws	Ch. 1, 2, 3	
3	1F – Jan. 16	Specific Energy – definition, diagrams, flow classifications	Ch. 5.2	
	2M – Jan. 19	*No Class – MLK Holiday*		
4	2W – Jan. 21	Specific Energy – Flows over bathymetry, choked flow		
5	2F – Jan. 23	Specific Energy – Contractions and expansions, losses		Homework #1 due
6	3M – Jan. 26	Uniform Flow – Force balance, normal depth equations	Ch. 5.1	
7	3W – Jan. 28	Uniform Flow – Cross-sectional design		
8	3F – Jan. 30	Uniform Flow – in composite channels		Homework #2 due
9	4M – Feb. 2	Hydraulic Jumps – Momentum analysis	Ch. 5.5	
10	4W – Feb. 4	Hydraulic Jumps – Energy analysis, other properties		
11	4F – Feb. 6	Hydraulic Jumps – Stilling basins		Homework #3 due
12	5M – Feb. 9	GVF numerical soln – derivation of GVF equation	Ch. 5.3	
13	5W – Feb. 11	GVF numerical soln – qualitative GVF (profiles)	Ch. 5.4	
14	5F – Feb. 13	GVF numerical soln – numerical methods		Homework #4 due
15	6M – Feb. 16	GVF – numerical methods	supplement	
16	6W – Feb. 18	Unsteady Flow – definition, kinematic wave routing	Ch. 9	
17	**6F – Feb. 20**	**Mid-term Exam #1**		**Mid-term #1**
18	7M – Feb. 23	Hydraulic Structures – weirs	Ch. 5.6	
19	7W – Feb. 25	Hydraulic Structures – flumes		
20	7F – Feb. 27	Hydraulic Structures – gates	Ch. 17.4	Homework #5 due
21	8M – Mar. 2	Culverts – part I	Ch. 16.2	
22	8W – Mar. 4	Culverts – part II		
23	8F – Mar. 6	Culverts – HY8 software		Homework #6 due
Mar. 9-13, no lectures – Spring Break – Enjoy…				
24	9M – Mar. 16	Stream Gauging – basics	supplement	
25	9W – Mar. 18	Stream Gauging – ADCP theory, prepare for field trip		
26	9F – Mar. 20	Field trip, **no class**		Homework #7 due
27	10M – Mar. 23	Incipient Motion – tractive stress equation	Ch. 18.1-6	
28	10W – Mar. 25	Incipient Motion – turbulent boundary layers, log-law		
29	10F – Mar. 27	Incipient Motion – Shields diagram		Homework #8 due
30	11M – Mar. 30	Sediment Transport – bedload sediment transport	Ch. 18.1-6	
31	11W – Apr. 1	Sediment Transport – suspended sediment transport		
32	**11F – Apr. 3**	**Mid-term Exam #2**		**Mid-term #2**
33	12M – Apr. 6	HEC-RAS – Introduction (CAD lab)	manual	
34	12W – Apr. 8	HEC-RAS – tutorial (CAD lab)		
35	12F – Apr. 10	ARCGIS – Introduction		
36	13M – Apr. 13	ARCGIS – work on tutorial (CAD lab)	manual	
37	13W – Apr. 15	ARCGIS – work on tutorial (CAD lab)		
38	13F – Apr. 17	HEC-GeoRAS – Introduction		
39	14M – Apr. 20	Work on project (CAD lab)	manual	
40	14W – Apr. 22	Work on project (CAD lab)		
41	14F – Apr. 24	*No Class* – (CAD lab outside of class)		
42	15M – Apr. 27	Work on project (CAD lab)	manual	
43	15W – Apr. 29	Work on project (CAD lab)		
44	15F – May 1	**Projects Due**		