

Course Number	CE 362
Title	Hydraulics
Section	002
CRN(s)	40463
Credits	4
Prerequisite(s)	EAS361 Fluid Mechanics or equivalent
Days/Time	Lecture: TR 1600 – 1730 Laboratory Sections: F 930 – 1050, 1130 - 1250, 1330 – 1450, 1500 - 1620, 1700 – 1820, 1830 - 1950
Location	Lecture: CIN 90 Laboratory: EB 130
Final Exam Day/Time	Tuesday, March 18 at 1530-1720

Course Website	http://web.cecs.pdx.edu/~hamidm/Courses/ce362 See Web site for course announcement, homework/solutions, discussion forum, laboratories, and other class materials
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Office Hours	W 1200 – 1330
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Required Text or Other Materials:

Fundamentals of Fluid Mechanics, 5th Edition, 2006 ISBN 0471675822
Authors: Munson, Young and Okiishi, Publisher: Wiley and Sons

Open Channel Hydraulics, 1st Edition, 2001
Author: Terry W. Sturm, Publisher: McGraw-Hill, ISBN 0-07-062445-3

Catalog Course Description:

The course covers application of the principles of fluid mechanics to flow in closed conduits, turbomachinery and open channels. Topics include flow resistance; laminar and turbulent flow; introduction to boundary layer theory; flow in pressurized closed conduits including pipes in series and parallel; turbomachinery including pump systems and turbines; uniform and nonuniform flow in open channels; gradual and rapidly varying flow; flow transitions; and unsteady flow. The course also addresses flow in irregular and compound channels, backwater flow modeling, analysis and design of hydraulic structures. Lecture and laboratory.

Course Objectives –Students must demonstrate the ability to

1. Write laboratory reports summarizing experimental data. This includes proper organization of laboratory reports, use of computer programs (Excel, or other such tools) for statistical and graphical analysis of data, and incorporation of concepts learned in class to experimental phenomena.
2. These are what I expect that you will be able to do at the end of Quarter. If you can do each of the following activities very well, then you will get an “A” grade.
 - A. Understanding the application of Reynolds Transport Theorem (RTT)/Control Volume on pressurized and open channel flow systems
 - B. Understanding the viscous flow, differentiation of laminar and turbulent flows, flow classification
 - C. Energy loss calculations including friction and minor losses in closed conduit and free surface flow systems
 - D. Single and multiple pipe flow analysis including series and loop networks
 - E. Classification and terminology of turbomachines, analysis of pumps in series and parallel, determining the pump performance characteristics and matching pumps to a pumping system, applying the affinity laws, introduction to turbines
 - F. General understanding of the principles that account for water motion in channels
 - G. Classification of free surface flows (uniform, non-uniform, steady and unsteady) and calculating properties of flow in open channels
 - H. Deriving and comparisons of the specific energy and specific force diagrams, analysis of choke and hydraulic jump
 - I. Analysis of uniform flow and design of the best hydraulic sections in open channel systems
 - J. Calculation of critical, normal, alternate and conjugate depths in open channel flow
 - K. Analysis of non-uniform flow including gradually-varied, rapidly-varied flow in open channels
 - L. Calculating the flow characteristics and preliminary design of hydraulic structures including weirs, culvert systems, spillways, and drop structures
3. Prepare neat and organized solutions to problem sets using theory developed in class.

Course Requirements:

1. **Problem sets:** Homework will be assigned throughout the quarter. Each assignment will be due one week after it is posted or assigned in class unless otherwise noted by the instructor.
 - 1-1. Do not leave the homework under doors, in mailboxes, etc.; it will be returned without a grade. No Late Homework will be accepted!
 - 1-2. Include the problem statement before your solution; be concise and clean and include any figure or diagram that explains the problem; highlight or underline the final answer.

2. **Laboratories:** Laboratory is a required part of the course and must be completed to receive a grade for the course. Attendance is required at all scheduled lab periods. Lab reports and other assignments are due the following week at the beginning of the lab period unless otherwise noted by the instructor.
3. **Exams:** There will be two quizzes, one mid-term and one final exam. No make-up exams will be given. You must be in attendance for all exams to receive credit.

Course Grading

Assignment	Proportion of Total Grade
Problem Sets	15%
Mid-term Examination	25%
Quizzes (2)	5% each
Final Examination	35%
Laboratory	15%
Total	100%

Incompletes: A grade of “I” is granted by the instructor only with prior approval and consent. Criteria are outlined in the PSU Bulletin.

Program requirements: {for UG courses} The CEE Department requires that junior and senior engineering courses complete with a minimum grade of C-, and a student’s cumulative PSU GPA must be 2.33 or higher to graduate from the BSCE program.

Course Schedule

The course outline lists the topic and the corresponding section of the textbook that will be covered in the class and you are expected to read. Note that this is a tentative schedule to class lectures. In particular, the date of the exams will be confirmed by an announcement in lecture. Do not claim that you missed the exam because it did not occur at the date listed in the schedule.

Course Schedule

Week	No	Date	Topic	Reading	Homework Assignment
1	1	Jan 8	Syllabus, Course introduction, Fluid mechanics review	3.5-3.8, 4.3-4.4	
	2	Jan 10	Viscous flow, Navier-Stokes equation and solution	6.8-6.10	
2	3	Jan 15	Similtude and dimensional analysis, Modeling, Buckingham Pi Theorem	7.1-7.5	
	4	Jan 17	Similtude and dimensional analysis, Modeling, Buckingham Pi Theorem (cont'd)	7.6-7.9.3	HW #1
3	5	Jan 22	Pipe system flow development, Velocity profile, Pressurized pipe flow characteristics, Laminar flow versus turbulent flow	8.1-8.3.1	
	6	Jan 24	Pipe flow dimensional analysis, Major/minor losses, Darcy-Weisbach and Hazen-Williams eqns.; Determination of head loss and energy line in single and multiple pipes	8.4-8.5	
4	7	Jan 29	QUIZ , Pipe systems in series and parallel, Water distribution systems (Pipe flow network analysis)	8.5-8.6, Class notes	HW #2
	8	Jan 31	Water distribution system (Cont'd)	Class notes	
5	9	Feb 5	Turbomachinery, Classifications and terminology, Pump operating point	12.1-12.4.2, 12.8-12.8.1	
	10	Feb 7	Net positive suction head (NPSH), Pumps in series and parallel, Examples, Similarity laws	12.4.3, 12.5	HW #3
6	11	Feb 12	MID-TERM EXAM		
	12	Feb 14	Open channel flow, Basic principles, Geometric elements for channels	10.1-10.2, S1.1-S1.6	
7	13	Feb 19	Energy consideration, Critical depth, Specific energy diagrams, Choke	10.3, S2.1-S2.6	
	14	Feb 21	Energy consideration (cont'd), Momentum consideration	10.3-10.4, S2.1-S2.6	HW #4
8	15	Feb 26	Momentum consideration (cont'd), Rapidly varied flow (RVF), Hydraulic jump, Sharp and broad crested weir Gates	10.6, S2.8, S3.1-S3.3	
	16	Feb 28	QUIZ , Uniform flow, Chezy and Manning equations	10.4, S4.1.1-S4.3, S4.9	
9	17	Mar 4	Uniform flow computations, best hydraulic section	10.6, S4.16-S4.17	HW #5
	18	Mar 6	Gradually varied flow (GVF) and classification	10.5, S5.1-S5.4	
10	19	Mar 11	GVF (cont'd)	10.5, S5.1-S5.4	
	20	Mar 13	Review		

Lab Schedule

Experimental Labs	Date	Lab Report Due
Lab # 1	Jan 25	Feb 1
Lab # 2	Feb 1	Feb 8
Lab # 3	Feb 15	Feb 22
Lab # 4	Feb 29	Mar 7

Computer and E-mail Accounts

- If you haven't done so already, please go to the CadLab located in EB 325 to activate your engineering account. If you need help in using this account, please see the attendant or send an e-mail to support@cecs.pdx.edu.
- If you choose not to check your CECS e-mail account regularly (yourname@cecs.pdx.edu) then please forward it to an e-mail account that you do check. Important information and announcements are delivered via this e-mail address.

Code of Conduct

The PSU Student Conduct Code prohibits all forms of academic cheating, fraud, and dishonesty. Further details can be found in the PSU Bulletin. Allegations of academic dishonesty may be addressed by the instructor, and/or may be referred to the Office of Student Affairs for action. Acts of academic dishonesty may result in a failing grade on the exam or assignment for which the dishonesty occurred, disciplinary probation, suspension or dismissal from the University. The students and the instructor will work together to establish optimal conditions for honorable academic work. Questions about academic honesty may be directed to the Office of Student Affairs: <http://www.ess.pdx.edu/osa/>.

Classroom Rules and Behavior Expectations

The classroom is a professional space and professional conduct is expected. Please silence your cell phone and refrain from text messaging during class and exam times. Treat your fellow students and the instructor with respect and please use appropriate language at all times. Additional rules may be added at the instructor's discretion.

Ethics and Professionalism

As future professional engineers you should plan to take the FE Exam (see the Oregon State Board of Examiners for Engineering and Land Surveying at www.osbeels.org), and you should be familiar with the ASCE Code of Ethics (www.asce.org/inside/codeofethics.cfm), which includes the following: Engineers shall act in such a manner as to uphold and enhance the honor, integrity and dignity of the engineering profession.

Campus Resources

As a PSU student, you have numerous resources at your disposal. Please take advantage of them while you are here. A small sample is listed below:
CEE Website: <http://www.cee.pdx.edu/>
Career Center: <http://www.career.pdx.edu/>
Center for Student Health & Counseling: <http://www.shac.pdx.edu/>
The Writing Center: <http://www.writingcenter.pdx.edu/>

PSU Disability Resource Center: 435 SMU - The PSU Disability Resource Center is available to help students with academic accommodations. If you are a student who has need for test-taking, note-taking or other assistance, please visit the DRC and notify the instructor at the beginning of the term.

Student Groups and Professional Organizations

Participation in student and professional groups can be a valuable part of your education experience. Membership gives students opportunities to get to know fellow students better, meet and network with professionals, collaborate in solving real engineering problems, learn about internship or job possibilities, socialize and have fun. Consider becoming active with a student organization, such as the following:

American Society of Civil Engineers Student Group (ASCE): <http://www.asce.pdx.edu>
Institute of Transportation Engineers Student Chapter (ITE): <http://www.its.pdx.edu/ite/>

Most professional organizations have monthly meetings and encourage student participation by providing discounts for lunch and dinner meetings. These meetings provide opportunities to network with potential future employers, learn about scholarships, and increase your technical knowledge. Take a look at these organizations as a starting point:
American Society of Civil Engineers (ASCE) Oregon Section: www.asceor.org
Institute of Transportation Engineers (ITE) Oregon Section: www.oregonite.org
Society of Women Engineers (SWE) Columbia River Section - <http://www.swe-columbia-river.org>
Structural Engineers Association of Oregon (SEAO): www.seao.org

Library and Literature Research

With the advent of the Internet it is very tempting to think that all necessary resources for a term project will be available in full text after typing in a few words at Google.com. This is not the case. You will often need to go to the library, use real library search tools and access real books and articles contained in refereed/archival journals.

Be sure to make use of the Vikat library catalog accessed via the PSU library home page at <http://www.lib.pdx.edu/>. Also available on the library home page are Full Text Electronic Journals and a list of on-line Databases. Databases to try are EI Compendex (<http://www.ei.org/ev2/ev2.home>) and Lexis-Nexis. Note that access to these databases is free for PSU students, but you must be using a computer on campus or via a dial-in service. See http://www.lib.pdx.edu/services/distance/proxy_server.html for instructions on how to gain off-campus access using a proxy server.

Campus Safety

The University considers student safety paramount. The Campus Public Safety Office is open 24 hours a day to assist with personal safety, crime prevention and security escort services. Call 503-725-4407 for more information.

For Campus emergencies call 503-725-4404.