

CVEN 311-501 “FLUID DYNAMICS”  
FALL SEMESTER 2012

TEXAS A&M UNIVERSITY  
ZACHRY DEPARTMENT OF CIVIL ENGINEERING

Instructor:

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Office hours: To be decided by class poll

Lectures: Mon/Wed/Fri 8:00 – 8:50 AM; Room 110, Civil Engineering Building

Text: Munson, Rothmayer, Okiishi, and Huebsch. (2013). *Fundamentals of Fluid Mechanics*. 7th Edition. John Wiley & Sons, Inc., Hoboken, New Jersey. ISBN: 978-1-1181-1613-5. The text will be on reserve in the library.

Course Description: *From the TAMU Undergraduate Catalog:* “Fluid properties; statics; kinematics; basic conservation principles of continuity, energy and momentum; similitude and hydraulic models; incompressible flow in pipes; fluid dynamic drag. Prerequisites: MATH 251 and CVEN 221; CVEN 302 or registration therein.”

Welcome to Fluids! This course is one of the basic “engineering sciences” along with statics, material mechanics, thermodynamics, etc., but I believe that it’s the most important of all these courses because it opens the door to some amazing things.

People all over the world are facing huge problems related to their long-term water needs as well as trying to keep water out of some places during floods, storm surges, and sea level changes. We continue to struggle to understand how the global climate system really works and how it might change over time. As we face a national and global energy crisis, many believe that we can capture significant energy resources from wind, tidal, geothermal, and new hydropower sources. Everyday biomedical researchers innovate new surgeries, therapies, prosthetics, and medical devices that require complex understanding of blood flow in the body. All of these things (and many more) start with a good understanding of fluid mechanics.

I sincerely hope that you’ll see this course as the beginning of a lifelong interest in some of the most important problems that engineers face. Always let me know what I can do to help you learn the course material and to keep your interest.

Course Objectives: The objective of this course is to introduce the applied physics of fluid statics and fluid dynamics to solve civil engineering problems. Specifically, after completing this course students should be able to...

- Calculate structural loads due to hydrostatic and hydrodynamic forcing
- Apply the laws of conservation of mass, momentum and energy to solve fluid flow problems in civil engineering applications

- Design hydraulic models at reduced scale that accurately predict the behavior of prototypes for civil engineering design
- Calculate fluid flows through pipes and pipe networks
- Estimate the fluid drag on solid bodies moving in viscous fluids

ABET Criterion 5 Contribution: Engineering science; Engineering Design

ABET Outcomes Addressed: (a) Ability to apply knowledge of mathematics through differential equations, science (including physics, chemistry, and one additional area of science), and engineering; (e) Ability to identify, formulate and solve civil engineering problems; (g) Ability to communicate effectively in oral and written forms

<u>Grading:</u>	Homework (lowest grade dropped)	10%
	Quizzes (lowest grade dropped)	20%
	Midterm Exam 1	20%
	Midterm Exam 2	20%
	Final Exam (cumulative)	30%

*Homework* assignments will be assigned each Friday and due at the beginning of class the following Friday (i.e., papers will be late at 8:01 AM!). No late homework will be accepted. Your lowest homework grade for the semester will be disregarded when computing your final average. Students may work together on homework assignments, and are encouraged to help one another. Blind copying of assignments is not permitted and will receive zero credit. The professor has final judgment on this last issue.

*Quizzes* will be given at the beginning of class on Fridays approximately every other week (see course schedule below). The quizzes will feature short-answer questions based on the assigned reading and/or a problem extremely similar to one on the homework from that week. Each quiz will be closed book, closed notes, no formula sheet; only a pencil and calculator will be allowed (see below for further rules). Your lowest quiz grade for the semester will be disregarded when computing your final average. Unexcused absences will be given grades of zero. The first excused absence from a quiz will count as the dropped quiz grade. Second and later excused absences will be allowed make-up opportunities as set forth in TAMU student rules. Arriving late to class on a quiz day is considered an absence for purposes of determining the grade on that quiz.

*Exams* will be traditional written exams completed individually. Two evening midterm examinations and a two-hour final examination are scheduled (see semester schedule below). We will decide as a class whether we will utilize the evening exam periods or hold midterms during normal class hours, and the dates/times will be announced well in advance. You will be allowed to bring in one 8.5 x 11 inch sheet of paper with formulas and notes on both sides. You must turn in the formula sheet with your exam. You will be allowed to use a calculator (without a QWERTY-style keyboard), and it is your responsibility to ensure that your calculator is working and will perform in the examination (bring extra batteries). All communications devices (e.g., cell phones, etc.) must be turned off and stowed out of sight in a closed bag or compartment. I know that many students rely on their phones to keep track of time; you should bring a wristwatch to tests and quizzes to tell time. Any violation of this rule will result in a

severe penalty that can include a grade of zero on the quiz or exam, reduction of semester grade, and/or report to the Aggie Honor Council, as appropriate.

Grading Rubrics: Below are given the rubrics for grading of homework, quiz, and test problems. Note that homework assignments are divided into two parts: problems graded on basis of effort, and problems graded on basis of accuracy. Each homework assignment will have about 2 to 5 problems that will be graded based on effort alone; you will receive full credit for simply making a reasonable attempt to solve the problem whether or not your answer is correct. One problem will be graded for accuracy.

**Grading Rubric for Effort-Based Homework Problems**

Percent of Total Points Awarded	Characteristics of Answer
100%	An honest attempt is made at independently solving the problem, with detailed steps clearly shown, a free-body or other relevant diagram drawn, and governing equations and assumptions stated.
0%	Otherwise <u>OR</u> blind copying of solution provided.

**Grading Rubric for Accuracy-Based Homework, Quizzes, and Exams**

Percent of Total Points Awarded	Characteristics of Answer
100%	Correct answer with detailed steps clearly shown, a free-body or other relevant diagram drawn, and governing equations and assumptions stated.
95%	All of the above, but <i>minor</i> computational errors led to obtaining an incorrect answer.
90%	Correct answer but <i>some</i> missing steps or details.
60 – 85%	Correct answer, but major steps or details are missing. <u>OR</u> An honest attempt is made at solving the problem, but the answer is incorrect. Some major conceptual or computational errors may be present. Work is organized enough to follow logical progression.
30 – 60%	An honest attempt is made at solving the problem, but the answer is incorrect. Severe conceptual errors present, problem is too disorganized to follow, and/or problem goal is misunderstood.
20%	Free-body or other relevant diagram, assumptions, governing equations, and problem statement present but no other work completed.
0%	Nothing shown/problem not attempted.

Absences: TAMU Student Rules (see <http://student-rules.tamu.edu/rule07>) provide clear guidance on excused versus unexcused absences and procedures for making up work missed due to an excused absence. Students are not required to notify the instructor or provide an excuse for a class day on which no graded assignment or activity takes place. Homework assignments will have due dates extended by the number of days of excused absence. Quizzes missed due to an excused absence will be handled as described above. Exams missed due to an excused absence will be made-up on an ad hoc basis pursuant to Student Rule 7. All excused absences (including illness less than 3 days) **must** have documentation submitted to the instructor pursuant to Student Rule 7.

Course Website: It's a good idea to check the course website frequently for announcements. The website will also be the means by which homework assignments, solutions, handouts, etc., will be distributed.

[http://ceprofs.tamu.edu/kbrumbelow/CVEN311/CVEN311\\_FD\\_Brumbelow.htm](http://ceprofs.tamu.edu/kbrumbelow/CVEN311/CVEN311_FD_Brumbelow.htm)

Semester Schedule: Below is the tentative schedule for the course this semester. Modifications to this schedule may be announced in class at any time. Do *not* plan major life events (e.g., travel, childbirth, religious conversion, etc.) around this schedule before consulting with Dr. Brumbelow. Please note the reading assignments and complete them *before* the relevant lecture.

Week	Dates	Activity	Topics	Reading
1	8/27-31		Introduction; Dimensions; Units; Ideal Gas Law; Viscosity; Compressibility; Surface Tension	Ch. 1
2	9/3-7	Quiz 1	Fluid Statics; Measuring Pressure	Ch. 2.1-2.7
3	9/10-14		Force on Surfaces; Buoyancy	Ch. 2.8-2.11
4	9/17-21	Quiz 2	Bernoulli Equation; Pressure Variation Normal to a Streamline	Ch. 3.1-3.4
5	9/24-28		Stagnation and Dynamic Pressure; Energy and Hydraulic Grade Lines; Restrictions	Ch. 3.5-3.8
6	10/1-5	Quiz 3	Fluid Kinematics	Ch. 4.1-4.2
7	10/8-12	<b>Exam 1</b>	Control Volumes; Reynolds Transport Theorem; Conservation of Mass; Continuity Equation	Ch. 4.3-4.4 Ch. 5.1
8	10/15-19		Newton's Second Law; Momentum Equations	Ch. 5.2
9	10/22-26	Quiz 4	First Law of Thermodynamics; Energy Equation	Ch. 5.3
10	10/29-11/2		Dimensional Analysis; Similitude; Hydraulic Modeling	Ch. 7.1-7.8
11	11/5-9	Quiz 5	Physical Modeling; Pipe Flow Characteristics; Laminar Pipe Flow	Ch. 7.9-8.2
12	11/12-16	<b>Exam 2</b>	Turbulent Pipe Flow; Friction Factors; Moody Diagram; Minor Losses	Ch. 8.3-8.5
12.67	11/19-21		Pipe Flow (continued); Minor Losses <i>Thanksgiving Holiday</i>	
13.67	11/26-30	Quiz 6	Flow around Bodies; Lift and Drag; Boundary Layers; Friction	Ch. 9.1-9.3
14	12/3		Review and Closure	
<b>Final Exam</b>			<b>Friday, Dec 7, 10:00 AM – 12:00 Noon</b>	

My Personal Statement on Honor Issues: I am a very strong believer in the Aggie Honor Code, and I hope you all realize how precious a thing it is to all of us. You are expected to abide by it continuously. If there is a question regarding any aspect of integrity in this course, it is *your responsibility* to ask Dr. Brumbelow as soon as possible. Honor violations will be dealt with severely.

Please come see me with any questions you might have. If my office door is open, then feel free to ask to talk to me. I'm happy to schedule appointments to see students as well.

Student Rules: TAMU Student Rules are posted at <http://student-rules.tamu.edu>. You should be familiar with these by now. Any issue not addressed explicitly in this syllabus will be governed by the Student Rules.

### **Official Notices**

ADA Statement: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit <http://disability.tamu.edu>.

Academic Integrity Statement: “An Aggie does not lie, cheat, or steal or tolerate those who do.” Students are expected to understand and abide by the Aggie Honor Code presented on the web at: <http://www.tamu.edu/aggiehonor>. No form of scholastic misconduct will be tolerated. Academic misconduct includes cheating, fabrication, falsification, multiple submissions, plagiarism, complicity, etc. These are more fully defined in the above web site. Violations will be handled in accordance with the Aggie Honor System Process described on the web site.

The handouts used in this course are copyrighted. By “handouts,” I mean all materials generated for this class, which include but are not limited to syllabi, notes, quizzes, exams, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts unless I expressly grant permission.

Cheating on quizzes and exams will not be tolerated. Cheating will be reported and handled in accordance with the Aggie Honor System Process. Some or all examinations will be closed book; “looking at another student's examination or using external aids (for example, books, notes, calculators, conversation with others, or electronic devices)” during these examinations is a violation of Texas A&M Aggie Honor Code, Cheating, unless specifically allowed in advance by the instructor.

Unless specifically allowed in advance by the instructor, all assignments and homework in this class are expected to be completed based on individual effort. Copying the work of others, including homework, is a violation of Texas A&M Aggie Honor Code, Cheating.