ENGR 3343 / 003 – Fluid Mechanics – Spring 2013

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Office Hours: 12:00-1:00 MWF, 2:00-3:00 TH, or by appointment

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Location: Q 314

Meeting times: MWF 1:00-1:50 pm

Start Date: 01/07/2012

Pre-requisites: ENGR 2214 Statics (pre-requisite) and MATH 2306 Differential Equations (co-requisite)

Textbook: Fluid Mechanics, by Finnemore & Franzini, 10th Ed., McGraw-Hill. Students are welcome to use a less expensive previous edition of the textbook under the understanding that assigned homework problems may not be the same in both editions.

Course Catalog Description: A study of the fundamentals of fluid statics and dynamics including hydrostatic forces on submerged plates, continuity of fluid flow and fluid flow principles. Applications of turbulent and laminar flow in conduits are emphasized. The systems approach is practiced in analyzing the application of flow measuring devices, piping, pumps and turbines.

Learning Outcomes:

Whether the student is studying Civil, Mechanical, Mechatronics, or Chemical Engineering, the principles of Fluid Mechanics are relevant and this course seeks to illustrate applications to everyday problem-solving. Students who successfully complete this course will have:

1. A good understanding of fluid mechanics fundamentals and fluid properties.
2. The ability to apply the Bernoulli equation to solve problems.
3. The ability to apply general energy equation to piping systems.
4. The ability to apply momentum equation to calculate reaction forces.
5. The ability to perform dimensional analysis/similitude and applications to hydro-dynamic machines.
6. The ability to analyze the aerodynamic characteristics of flows over bodies and shapes.
7. Have an understanding of the necessary background materials needed for successful completion of the Fundamentals of Engineering examination in Fluid Mechanics.

Topics Covered Include:

1. Introduction, Definitions, Basic Laws, Properties
2. Pressure, Manometer, Submerged Surfaces, Buoyancy
3. Fluid Kinematics, Reynolds Transport Theorem (RTT)
4. Conservation of Mass, and Continuity Equation
5. Conservation of Energy.
6. Bernoulli Equation and its Applications
7. Linear Momentum Equation
8. Energy losses in Pipe Flows: Major and Minor Losses
9. Pumps; Pump performance
10. Open Channel Flows
11. Dimensional Analysis and Similitude
12. Drag and Lift
13. Compressible Flows

Grading Policy

Homework (20%): Homework is an essential component of the learning experience in this course. Students who successfully complete and understand all the assigned homework problems will find themselves well prepared for the written tests. Content and numerical results are certainly important in homework problems, but problem presentation is of equal importance. This includes a well-conceived diagram containing all information pertinent to the problem, an algebraic solution for the desired quantity in terms of given/known quantities, correct and consistent use of notation, units, and significant figures, as well as overall neatness and clarity. The assigned homework problems will be collected during class periods as detailed in the course schedule, and two or three of them will be graded. The lowest homework problem grade for the semester will be dropped. A grade of zero will be recorded for any problem whose solution appears copied, even in part, from another source. Be sure to write the solution "in your own words" when collaborating with students from other groups on the solution method. Students who feel they are unfairly assessed a zero for copying homework may request referring the matter to be resolved by the SPSU Honor Council. The instructor may decide to refer to case to the Honor Council in especially egregious cases or when a student is involved in multiple incidences of copying. Each submission may include two students' names, and problems are graded according to the rubric:

Proper submission including diagram with given quantities when appropriate (2 points)
Correct identification of problem solution method (2 points)
Significant progress made towards solving the problem (2 points)
Appropriate determination of material properties including assumptions made (1 point)
Algebraic expressions carried out as far as possible (1 point)
Correct and consistent use of units (1 point)
Answer obtained correctly to 3 significant figures (1 point)

Group exercises (20%): Most lecture periods with a reading assignment will begin with a "five-minute" group exercise. The purpose of these exercises is to stimulate learning of new material in groups of two members. Questions on group exercises will be short and generally require only that students have thoroughly read the day's reading assignment. Examples of question topics include definitions, identifying symbols or notation, and drawing/interpreting diagrams. The lowest group exercise grade for the semester will be dropped. Group exercises are graded out of 4 points, and any honest attempt at answering the question will receive at least 2 points.

Tests (2x20%): Two in-class tests will be used to assess progress in the course. Tests consist of four questions, three of which are 28 points each and cover problems similar to those assigned as homework or worked in class. The fourth problem is worth 16 and will cover a topic of theory or derivation. Submissions for this problem will receive a grade of 16 points if essentially correct, 8 points if significant progress is made, and 0 points if little relevant information is provided. Neither calculators nor equations sheets will be allowed on the tests. However, both sides of the front flap of the book and selected equations will be provided on the test and made available in advance of the test. The tests, in general, will be curved in an attempt to maintain an overall class average of a mid C.

Final exam (20%): The format of the comprehensive final exam will be similar to that of the other tests but twice as long in length. The final exam will be scheduled during the standard final exam period.

The scale for the final course grade is as follows:

A 90-100
B 80-89
C 70-79
D 60-69
F 0-59

Attendance Policy

Forcing everyone to come to every class is not practical. Each student bears responsibility for material covered in class. If you choose to miss class, that is your decision. However, completion of group exercises goes hand-in-hand with attendance. Note also that late arrival to class will result in working alone on group exercises. Class time will be spent primarily working problems, under the assumption that all students have read the day's reading assignment and watched the recorded lecture. In general, late assignments are not accepted nor can make-up tests be administered. Extenuating circumstances can result in exceptions to this rule, but agreement must be reached with the instructor in advance of the assignment or test which will be missed.

Academic Misconduct

At SPSU, academic misconduct is defined as "any act that could have resulted in unearned advantage or that interferes with the appropriate academic progress of others". All acts of academic misconduct will be reported to the Honor Council. For more information see www.spsu.edu/honorcode. The application of the definition of academic misconduct for each category of assignment in this course is describes as follows:

Discussion of homework problems among peers and even other sources is wholeheartedly encouraged. A single homework submission is allowed for groups of no more than two members. Note, however, that this submission must be a reflection of the group's work alone. Multiple submissions may appear similar if the same solution process is followed, but they may not be copied, not even in part. Be aware that copying of any kind from any source, including clandestine solution manuals, will be considered a violation of academic integrity. If you have a copy of the solution manual, you are strongly recommended to delete it. Using the solution manual as a crutch when solving homework is detrimental to your learning, and the temptation is great to rely heavily on it when rushed to complete a homework set. The majority of reported academic integrity violations in this course result from students copying from the solution manual. Additionally, possession of the solution manual is unnecessary as you will be provided with detailed solutions of all homework problems after they are due, as well as for non-assigned problems upon request.

Collaboration among group members during group exercises is obviously encouraged, but assistance of any kind from outside the group will be considered a violation of academic integrity.

Tests and the final exam are to be reflections of the individual's work alone. Assistance of any kind, including notes, calculators, cell phones, etc. will be reported as a violation to the Honor Council.

Disability Statement

If you have a documented disability as described by the Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) that may require you to need assistance attaining accessibility to instructional content to meet course requirements, please contact the ATTIC at 678-915-7361 as soon as possible. It is then your responsibility to contact and meet with the instructor. The ATTIC can assist you and the instructor in formulating a reasonable accommodation plan and provide support for your disability. Course requirements will not be waived but accommodations will be made, when appropriate, to assist you to meet the requirements.

Communication

Course material will be disseminated in D2L including lecture notes and recordings, homework solutions, old tests, etc. All official course announcements, including instructions when class may be cancelled, will be posted in the D2L course news. Be sure to check D2L regularly.

Course Schedule

Day	Date	Description	Reading	Homework due
Mon	01/07	Introduction	1.1-1.5	
Wed	01/09	(1) Fluid properties	2.1-2.13	
Fri	01/11	(2) Pressure measurement	3.1-3.5	
Mon	01/14	Recitation		
Wed	01/16	(3) Submerged forces	3.6-3.10	1.5.3, 2.3, 2.4, 2.17, 2.23
Fri	01/18	Recitation		
Wed	01/23	(4) Fluid flow basics	4.1-4.10	
Fri	01/25	Recitation		
Mon	01/28	(5) Vector fields	4.11-4.13	3.1, 3.12, 3.15, 3.21, 3.27
Wed	01/30	Recitation		
Fri	02/01	(6) Bernoulli equation	5.1-5.7	
Mon	02/04	Recitation	5.8-5.10	4.1, 4.6, 4.19
Wed	02/06	(7) Hydraulic grade line	5.11-5.14	
Fri	02/08	Recitation		
Mon	02/11	Review		5.14, 5.30, 5.38
Wed	02/13	Test 01		
Fri	02/15	(8) Momentum and force	6.1-6.5	
Mon	02/18	Recitation		
Wed	02/20	(9) Rotating machines*	6.11-6.15	
Fri	02/22	Recitation		
Mon	02/25	(10) Similitude*	7.1-7.7	6.10, 6.15, 6.42
Wed	02/27	Recitation		
Fri	03/01	(11) Laminar flow	8.1-8.8	
Mon	03/11	(12) Turbulent flow	8.9-8.13	7.9, 7.30
Wed	03/13	Recitation		
Fri	03/15	Single pipe flow	8.14-8.18	
Mon	03/18	Recitation		
Wed	03/20	(13) Minor losses	8.20-8.26	8.7, 8.12, 8.31, 8.34
Fri	03/22	(14) Machines and branches	8.27-8.29	
Mon	03/25	Recitation		
Wed	03/27	Multiple pipe systems	8.30-8.32	
Fri	03/29	Recitation		
Mon	04/01	Review		8.40, 8.42, 8.55, 8.56, 8.62, 8.67
Wed	04/03	Test 02		
Fri	04/05	(15) Immersed bodies	9.1-9.5	
Mon	04/08	Recitation		
Wed	04/10	(16) Drag and lift	9.6-9.14	
Fri	04/12	Recitation		
Mon	04/15	(17) Open channel flow	10.1-10.3	9.4, 9.13, 9.32, 9.46
Wed	04/17	Recitation		
Fri	04/19	(18) Compressible flow	13.1-13.6	
Mon	04/22	Recitation		10.2, 10.3
Wed	04/24	(19) Pump selection	15.1-15.13	
Fri	04/26	Recitation		
Mon	04/29	Review		13.1, 13.4, 15.37, 15.57

This course schedule is subject to modification depending on the pace of the course. However, homework assignments and test dates will not be changed unless students anonymously and unanimously vote for a change.