CE300: Fluid Mechanics
Spring 2008

Instructor: James Warner, Department of Civil Engineering GroundWater Program
Class Room: 10:00 – 10:50 MWF: Wagar Room 133

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Text Book: Fluid Mechanics with Engineering Application, 10th ed by Finnemore & Franzini..

Course Description

Fluid Mechanics is one of the 4 major mechanics courses that are the basis of Civil Engineering. The other three being: Statics, Dynamics and Solid Mechanics/Strength of Materials. Fluid mechanics can be divided into fluid statics (the study of fluids at rest), and fluid dynamics (the study of fluids in motion). Classical Fluids Mechanics includes both liquids and gases with the primary focus on the mechanical properties of fluids (in contrast to environmental fluid mechanics with the focus on chemical properties of fluids). Fluid Mechanics provides the introductory theoretical foundation and practical application to fluids at rest and in motion and is considered the father course to many other more specialized courses:

•**Hydrodynamics** which is a branch of theoretical fluid dynamics that deals with flow of an ideal fluid (an ideal fluid is both incompressible and inviscid)

• **Aerodynamics** which is a branch of theoretical fluid dynamics that deals the motion of a solid body through air and other gases

• **Hydraulics** is the practical application of principle of fluid mechanics to design and use of man-made engineering structures for the measurement and control of liquids (mostly water). Topics include pipe (closed conduit) flow, open channel flow, dam design, hydro power, water distribution systems (pipe networks), diversion structures, pumps/turbines etc.

•**Hydrology** is the study of the movement, distribution, and quality of water throughout the Earth, and thus addresses both the hydrologic cycle and water resources. A practitioner of hydrology is a hydrologist, working within the fields of either earth or environmental science, physical geography or civil and environmental engineering. Oceanography and meteorology are not included because water is only one of many important aspects.

Students Should Know

•Basic fluid properties including density, viscosity, surface tension, compressibility, vapor pressure etc (definition and importance in).

• Solve problems involving fluid statics, measurement of pressure, buoyancy and hydrostatic pressure forces on plane and curved submerged surfaces.
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•. Euler and Bernoulli Equations

•. Reynolds transport theorem. (LaGrangian versus Eulerian approaches).

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Students Should Know (Continued)

• Solve problems of fluid motion using conservation of:
- Mass or volume rate of flow,
- Energy, and
- Momentum.

.• Concepts of Dimensional Analysis.

• Solve fluid problems involving:
- Pipe flow (pressurized conduits)
- Surface resistance (boundary layers and drag on submersed objects)
- Turbomachinery
- Open channel flow
- Measurement of rate of flow.
- Draw energy and hydraulic grade lines

• Solve simple problems involving compressible flow.

Course Vision

Building on the past, reaching for future to help all mankind by providing safe structures to withstand the combined forces of air and water and to provide a safe abundant and sustainable water supply for the human health and environment.

Laboratory Sessions

L01: 3:10 - 6:00 pm Monday A4 Engineering
L03: 3:10 - 6:00 pm Wednesday A4 Engineering

Mandatory Attendance

This class has a mandatory attendance requirement. Excessive absences are very detrimental to learning. Your grade will be penalized after 3 un-excused absences. Excused absences for illness, club sports trips, conferences, weddings etc are not penalized. However an "**Approved Excused Absence Request Form"** must be filled out (in advance if feasable).

Grading Weights

Lecture 80-85% Laboratory 20-15%

Lecture Grading:

	Approximate Grading Weights
Homework	0.75 - 1.0
Midterms (2)	2
Third Midterm (??)	1
Final Exam	1.5
Quizzes	0.25

Grading weights given above are only approximate. Actual grading weights will depend on actual number of midterms, quizzes and homework problems given.

Grading Scale

96 - 100%	A+	85 - 88%	B+	75 - 78%	C+	58 - 65%	D
92 - 96%	A	81 - 85%	B	68 - 75%	C	< 58%	F
88 - 92%	A-	78 - 81%	B-	65 - 68%	D+		

Minimum Homework Average

Student must earn at least 60% on homework average or they will be dropped 1 full grade in the final course grade".

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Course Philosophy

In the learning of Fluid Mechanics, like the previous mechanics courses, there is no substitute for working problems. During the class lectures I will attempt to:

- minimize derivations
- teach the underlying theoretical concepts (why)
- emphasis on working problems similar to homework problems

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A minimum level of background information including derivation of some equations is required. However there is more theory in Fluid Mechanics than in the previous 3 mechanics courses.

Soap Box

Engineers are frequently criticized for simply plugging numbers into their formulas (equations) to get an answer without checking to find out if the answer makes physical sense. The engineer needs to ask hin or her self::

- •Does answer make physical sense?
- •What is the expected range in outcomes of the answer?
- •What is the accuracy of my calculated/measured answer? (Plus or minus 10%? 20%? etc.)
- • Are there other methods of calculating/determining/estimating the same quantity?

Examples: What is the water pressure at my house?
What constitutes the design life of the bridge? / building? / pipeline?
How do you calculate/estimate the 100 year flood? 20 year traffic demand?
How do you measure/calculate the river flow rate? Pipe flow rate?
Is the flow laminar or turbulent and why do I care?

Encouraged to form Study Groups

The best way to learn Fluid Mechanics is byworking the homework problems. It has been my experience that a person can watch another person work a problem and fully understand how the problemwas solved. However in solving the problem oneself, a “spark of inspiration”to get started is frequently needed that is only obtained by working the problem on his or her own. However I plan to ask test/quiz questions on definitions and assumptions and major steps in derivation of major equations.

“Homework Cover Sheet”

I expect each student to turn in all of the homework assignments!! Homeworkis to be done in a professional manner. Attach “**Homework Cover Sheet”** to all homework assignments (this will be emailed to you). The Homework Cover Sheet lists the **“Homework Rules”** to be followed. Follow these rules!!

“Error Review Sheet”

Attach “**Error Review Sheet**” to any homework assignment or test that you suspect contains a grading error and you would like to have reviewed.

Seating

Wagar 133 is a wide rather shallow room. Due to reflection off the white board, it is very difficult to see from the far sides of the room. Please sit in the center of the room. .

Weekly and or Periodic Quizzes

Weekly/periodic quizzes are planned. Missed quizzes will be made up only for excused absences..

Prediction

Within 20 years almost all structural design of buildings will be done in China and or India.