JME 3700

Introduction to Fluid Mechanics

General Overview

Instructor: Prof. Michael Wendl

Assistant: Hao Pan (haopan@wustl.edu)

Time: Tuesdays and Thursdays 5:30 pm to 7:00 pm

Location: Whitaker Hall, Room 216

Synopsis: This course is an introductory treatment of the principles of fluid mechanics, specifically fluid statics and incompressible flow. Overarching principles are the conservation laws for mass and momentum. We will also cover the concepts of continuum modeling, viscosity, pressure & velocity, vorticity, and streamlines. Specific topics will be discussed, including hydrostatic forces, inviscid flow, integral & differential analysis, dimensional analysis, viscous flow in pipes, boundary layers, and open–channel flows.

Textbook: The official textbook for the course is "Fundamentals of Fluid Mechanics" (7th edition) by Munson, Okiishi, Huebsch, and Rothmayer. This edition is widely available *new* from many sources (listing for around $160). However, this book will mostly be useful for our purposes in the context of the reference tables and examples. An older (and much cheaper) edition will also suffice and these are available from Ebay, AddAll, etc. in the $1 to $10 range.

Prerequisites: Dynamics (W.U. MEMS 255 or equivalent); Advanced Engineering Mathematics (W.U. ESE 317 or equivalent)

Description: JME 3700 is a required course for Civil and Mechanical Engineering Majors and counts for 3 units of credit.

Focus	Component	Credit
Engineering Science	100%	3
Engineering Design	0%	0
Other	0%	0
Total	100%	3

Goals for JME 3700

1. Apply fundamental scientific and engineering concepts in order to identify, formulate and solve a variety of mechanical engineering problems.
2. Be exposed to modern developments, products and tools as they relate to engineering practice.
3. Be exposed to practicing engineers and their jobs and be taught the importance of high ethical and professional standards.
4. Obtain the broad–based education necessary to understand the impact of engineering solutions in their global and societal contexts.

Grading Basis

Please read this section very carefully! It describes the *non–negotiable* policies and procedures that will be followed for this course in ultimately determining your grade.

Grading Formula: The following basis will be used in determining final *numerical* grades for the course. (Please read the companion sub–section further below that explains how numerical grades are converted to the letter grades that will be reported to the Dean's office.)

Part	Component
Midterm Exam	30%
Final Exam	30%
Combined Homeworks	25%
Participation	15%
Total	100%

Midterm Format: One in–class test will be given during the semester (see syllabus). It will stress conceptual understanding and problem–solving capability. Rote memorization of formulas and/or equations is not expected. To this end, **you will be allowed to bring a single, standard index card (3" by 5") with notes, formulas, etc. into the test.** No other resources will be permitted in the test. Any student who cannot appear for the midterm test must inform the instructor at least a week prior to the exam in order to be eligible to take a make–up midterm during reading week (the week before final exams).

You will receive only a point–based "raw score" on this test, i.e. the number of points you earned out of the maximum possible value of 100. *There is no basis for converting*

this score to a letter grade, nor will a letter grade be assigned at this stage. Letter grades for the entire course are only assigned at its conclusion (see below) and any effort on your part to estimate your own letter grade based on this test may lead to an erroneous or misleading result. The instructor will additionally report the midterm statistics, i.e. average and standard deviation.

Final Exam Format: Same details as for midterm, except the final will cover only material presented in the second half of the course and there will be no make–up available.

Combined Homeworks: Check the syllabus for the homework schedule. Problems are to be done on standard 8.5" $\times$ 11" paper in a neat and legible manner. You are permitted to work with others, but the work handed in *must be your own work!* Homeworks will nominally be due in class one week after being assigned. However, this is an informal deadline. This will give you some slack on particularly busy weeks with your other classes, but I urge you not to fall behind! Homeworks will **NOT** be accepted after their solutions are posted. **There will be no exceptions!** No make–up homeworks will be assigned, nor will extra credit be available. Again, **no exceptions**.

Participation: Your grade will also depend upon the instructor's somewhat subjective judgment of "participation", which includes attendance, preparation and ability to participate in in–class discussion, etc. Attendance is not tracked, but missing a lot of class sessions will certainly be noticed.

Determination of Final Letter Grade: There is no universally accepted way of assigning letter grades, i.e. the grades that are reported to the Dean's office, for any course and there are criticisms that can be leveled at any specific method chosen by an instructor. For those that are interested in this level of detail, I shall only give some concerns for this problem and a brief explanation of my own method, which is commonly used. This is not a justification or an invitation to debate my grading system. It is only furnished so that you may understand the specific way in which your letter grade will be computed.

The evaluation metrics of a course (homeworks, tests, etc.) vary by instructor for multi–section courses and even year–to–year for the same instructor. For example, perhaps questions for this year's midterm were more difficult or they involved lengthier calculations than those on last year's midterm, etc. so the numerical grades will overall be lower than last year. Consequently, it is impossible, in a strict sense, for any absolute (fixed) grading scheme[1] to be completely fair. I do not use such a system.

Rather, I rely on the fact that core courses normally have fairly large numbers of students in a section. Statistics then furnish a good basis of assessing individual grades based on class average and standard deviation[2] because they do not strongly depend

[1] An example of such a scheme would be $\geq 90\%$ is an "A", $\geq 80\%$ is a "B", etc.

[2] This is sometimes pejoratively referred to as "grading on the curve".

on one or maybe a few individuals whose outlier scores (either high or low) might otherwise strongly skew others' grades. Boundaries between letter grade assignments are almost always obvious. There are *no* quotas, e.g. x number of students must get an "A", or y students must fail. I would guess that any instructor hesitates to assign a fail, but in instances where this has actually occurred in the past, such cases have never been borderline in my experience.[3]

Other Policies and Procedures

Academic Integrity: You are bound by the School's code of academic integrity, the proprieties of which will be strictly observed. Infractions are grounds for failing the course.

Help Sessions: The instructor will be available briefly after class periods to answer any additional questions regarding homework, etc. If there is a need for a regular weekly help session, one will be arranged.

Class Notes: There is a formal set of notes for the class, which you are encouraged to download — these notes are free. The instructor will follow these notes rather closely, so it is strongly suggested that you print them and carry them to class.

[3]For example, failing numerical scores have often been > 3 standard deviations below the class average.