ME 225 Introduction to Fluid Dynamics Fall 2017

Instructor: Hussein Aluie email: hussein*&At**rochester.edu
Hopeman 406 phone: 585-276-7170

Office Hours: MWF 10:00am – 11:00am, or by appointment

Lectures: MWF 9:00 – 9:50 am Hutchison 140

Recitation: T 2:00 – 3:15 pm Dewey 1-101

During the three "lectures," the instructor will typically present new material and work through examples. During the "recitation," the teaching assistants will typically discuss homework problems and review some material the students might be having difficulties with.

Course Material:

Course material, including lecture notes, PowerPoint slides, sample exams, HW solutions, hints, etc … will be available on Blackboard. Any student registered for the class should have access to Blackboard.

Course Webpage:

http://www.complexflowgroup.com/courses/Fall 2017/ME225/

The course webpage has office hours for TAs and instructor, HW due dates, HW assignments, Exam dates, syllabus, etc. ....

Prerequisites: MTH 163, MTH 164, PHY 121, ME 120, ME 123

Text: *A brief Introduction to Fluid Mechanics,* 5th edition,
by D. F. Young, B. R. Munson, T. H. Okiishi, and W. W. Huebsch, Wiley 2011.

Course Outline: You are responsible for all material in the textbook sections listed below, as well as all material covered in the lectures and in the problem sets. The lectures will cover most, but not all, of the assigned material in the text and will include examples and applications. However, it is still imperative to attend all lectures which will sometimes cover additional material not in the textbook. You should read ahead in the text to prepare yourself for the lecture and benefit the most out of it. Topics to be covered are:

Chapter 1 (all) Introduction: dimensions and units of physical quantities, the continuum hypothesis, pressure and temperature scales, fluid properties.

Chapter 2 (all) Fluid Statics: pressure field, pressure gradients, hydrostatic equation, manometry, hydrostatic forces on surfaces, buoyancy and flotation.

Chapter 3 (all) Bernoulli Equation: Newton's 2nd law for a fluid particle, streamline coordinates, the Bernoulli equation and applications.

Chapter 4 (all) Fluid Kinematics: Eulerian and Lagrangian descriptions, velocity and acceleration fields, material derivative, control volume representations, Reynolds transport theorem.

Chapter 5 (sec 5.1-5.2) Control Volume Analysis: Integral forms of continuity, momentum, …, and applications.

Chapter 6 (all) Differential Analysis: fluid particle kinematics, equations of continuity and momentum, stream function, inviscid flow, Euler equation, potential flow, viscous flow, Navier-Stokes equation, laminar viscous flow.

Chapter 7 (all) Similitude, Dimensional Analysis, Modeling: dimensional analysis, the Buckingham Pi-Theorem, applications, common dimensionless numbers, modeling and similitude.

Chapter 8 (sec. 8.1-8.5) Viscous Flow in Pipes: laminar flow, turbulent flow, empirical analysis, Moody diagram, applications.

Chapter 9 (all) Flow Over Immersed Bodies: lift and drag, boundary layers, boundary layer flow over flat plate, pressure gradient effect, flow separation, lift and drag coefficients, empirical results.

References: The references below are on reserve at the library.

1) Munson, Young, Okiishi, *Student Solutions Manual for Fundamentals of Fluid Mechanics*, Wiley, 1998.
2) Munson, Young, Okiishi, *Fundamentals of Fluid Mechanics*, Wiley, 2006.
3) Van Dyke, *An Album of Fluid Motion*, Parabolic Press, 1982.
4) Batchelor, *An introduction to Fluid Dynamics*, Cambridge University Press, 1967.

Homework: A list of weekly problem sets along with due dates can be found at the course webpage. Although you may discuss homework problems with me, teaching assistants, or your classmates, you are expected to work out the problems independently (see Academic Honesty).

Format of HW assignments:
There is no specific format for the HW assignments. Please write legibly. Please answer the Ethics questions for HW1 and HW2 on pages separate from the main textbook problems. You will receive separate grades for the Ethics questions and for the textbook problems. However, you should staple them together as a single HW assignment.

When to turn in HW:
You are expected to put your homework assignment in the Head TA's mailbox on the due date, typically by 5pm of that day unless noted otherwise on the course webpage. Late HW submissions will receive a zero grade unless permission is obtained from the instructor *before* the due date.

Where to turn in HW:
DO NOT slide your HW under my office door!!! Any HW slid under my door from now on will be considered late and not be graded. Please put your finished HW assignment in the Head TA's mailbox. Graduate student mailboxes, including the Head TA's, are located just outside the ME department's office (Hopeman 235) on the 2nd floor of Hopeman.

Exams: In addition to a 3-hour final exam, there are three regular exams during the semester. The lowest score of the three regular exams will be automatically dropped and will not count toward your final grade. In case you miss an exam, your score on that test will be zero without an option for a make-up. This means that you can miss only one exam without negatively impacting your final grade. All exams will be closed book. The regular exams will be given during recitation sessions. Exam dates are posted on the course webpage.

Academic Honesty: http://www.rochester.edu/college/honesty/
You may discuss homework problems with others, but you must **not retain** written notes from your conversations with other students, or share data electronically (e.g. files, emails, etc …) to be used in completing your homework. Your written work must be completed without reference to such notes, with the exception of class and recitation notes.

Classroom etiquette: Please try to arrive on time for each class. Late arrivals are distracting. If you arrive late please enter quietly and take a seat near the back of the room. Please do not converse with your classmates during class. All electronic devices (cell phones, iPods, iPads, laptops, …) must be turned off and stowed.

Grading: Each of the three regular exams will count as 100 points (with only the two highest scores counting toward the final grade), the final exam will count as 200 points, and the homework will count collectively as 100 points, for a total of 500 points. Your final grade for the course will be based primarily on your total point score, but other appropriate factors, such as participation and personal initiative, will also be taken into account.

Conversion to letter grades:
After dropping the lowest midterm, I will average (with appropriate weights as described above) all numerical grades and convert your final numerical grade to a letter grade per the following table. For example, in the table below, a grade of 93 is an A but a grade of 92.5 if an A-, and so on.

0	F
0.59	D
0.69	C-
0.73	C
0.77	C+
0.8	B-
0.83	B
0.87	B+
0.9	A-
0.93	A