

PHYS 299: Special Topics: Fluid Mechanics

Spring 2019

Location: Trex 273

Time: MWF 9:40-10:40

Instructor: Dr. Evan M. Aguirre

Email: aguirre@roanoke.edu

Office Hours: MWF 11:00-12:00 and Th 1:30-2:50, also by appointment **Office:** Trexler 266B

Required Texts:

Munson *Fundamentals of Fluid Mechanics 7th ed.*

Other texts of interest:

The Physics of Fluids and Plasmas by Choudhuri

Fluid Mechanics 6th ed. by Kundu

Overview

Fluid mechanics is not a fundamental branch of physics in the same manner as Classical Mechanics, Electricity and Magnetism, or Quantum Mechanics. Instead, it is an application of continuum mechanics (classical mechanics). In plasmas, where particles are charged, fluid mechanics becomes magnetohydrodynamics (MHD) which is still an application of more fundamental physics.

Therefore, fluid mechanics is rarely taught in a physics department. It is quite often taught in engineering departments because it is very useful for mechanical and aerospace engineering. Graduate level classes will occasionally cover fluid mechanics by itself but it is more often taught as an application (MHD for example). Obviously this class is being offered in a physics department. The objective of this course is to develop a deep understanding of the physics of fluids and to use that understanding in applications to engineering and real life situations.

Intended Learning Outcomes

By the end of this course, successful students will be able to:

- Understand advanced concepts in fluid mechanics
- Apply and analyze the physics of fluids in a variety of systems
- Evaluate physical systems to determine what fluid phenomenon are present and relevant

Class Expectations and Attendance

- You should be most interested in genuine learning for your physics/engineering career and not as focused on your grade or simply getting through the class.

- It is expected that you will put forth a sincere effort. We will likely do some active learning techniques - please be willing to try it out.
- It is expected that you will do the pre-class activities, such as reading the textbook and doing homework, before class.
- This course should be treated as guided independent study. Mere attendance is insufficient to obtain the desired level of understanding. Reading course resources, attending lectures, participating in classroom activities, and doing homework is necessary but not sufficient. You won't deeply learn the material unless you choose to (and you put in the effort).
- If you are going to be absent from class then please notify me ahead of time. You are accountable for all work missed because of an absence.
- We will spend a majority amount of class time in a traditional lecture format. You have likely gotten used to writing down notes while someone is talking to you. Writing down notes is a useful exercise, but should not be your goal. The goal is understanding the material, and your notes should help foster this. For most students, something has to be processed at least three times before it becomes known. A good strategy is to (1) read the portions in the book before class, (2) come to class, and (3) go over the notes after class. When you go to do the homework, you will be better suited to be successful. Do not carry out course activities with the goal of merely finishing them - take time to make connections with previous topics and to think about future topics. Make notes of questions and ask them in class.
- Since not everyone learns best in the lecture setting, we will spend some time doing problems in small groups. If you treat this as busy work, you will not get anything out of it. Rather, engage in the process and work towards their goals. Education research shows that this approach is actually more effective than hearing a lecture (for most students).
- I am not responsible for your failures if you do not put forth the effort. If you are having trouble then please ask questions or seek me out in office hours.

Evaluation

This course expects you to spend at least 12 hours of work each week inside and outside of class.

Grading

- Participation and Notes 10%
- In-class activities 10%
- Homework 40%
- Midterm 20%
- Final Exam 20%

The grading scale is as follows: **A** 100-90, **90** < **B** < 80, **80** < **C** < 70, **70** < **D** < 60, **F** < 60. I will not be giving pluses and minuses. I reserve the right to adjust grade scales (i.e., curve) in the interest of fairness and propriety if warranted.

Participation and Notes

As stated above you are required to read the assigned pages before class. If it becomes apparent that the class is not doing this, I will make everyone turn in notes before class (as in a flipped classroom). I may occasionally ask you to do this so that I may gauge how much learning you are accomplishing by reading the textbook.

Homework

Homework will be designed to challenge you beyond mere regurgitation. You are encouraged to collaborate with your fellow classmates but you must turn in your own work. Late homework will be accepted up to one class period late but with a 40% deduction.

Midterm and Final

There will be a midterm and final throughout the semester. Make-up on the midterm or final will only be allowed as a result of a discussion with me beforehand (with a compelling reason) or in emergency situations (death, hospitalization, court, etc.). The midterm will be on Feb. 27th (the Wed. before spring break). **The final exam is April 25th from 2:00 - 5:00.**

In class activities

During class time, probably in the second half of class, you will work in groups on problems which may be applications, derivations, or qualitative exercises. You must be in attendance to earn these points and you will do so without regard to whether your solution is correct.

Academic Integrity

I subscribe to the college academic integrity (AI) policies linked below. Students are expected to be familiar with these policies. As in real life, failure to learn the rules is not an excuse. Please contact me if you have any questions. Be aware that I am contractually obligated to report students if I suspect that they have engaged in academic dishonesty.

During in-class activities, I encourage you to discuss topics and learn from each other. However, unless specifically stated otherwise, you are expected to individually complete all steps of the activity and to turn in your own work. Homework and other assignments (unless specifically stated otherwise) are to be completed individually. Misrepresentation of your contribution to a group effort will be considered a violation of the academic integrity policy. Copying and pasting directly from a web site and claiming it as your own work is the same as copying and pasting directly from a book—both are violations of the academic integrity policy and will be treated accordingly. The full AI policy can be found online at: <http://roanoke.edu/A-Z Index/Registrar/Policies and Information/Academic Integrity.htm>.

Special Services

Accessible Education Services (AES) is located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Dr. Sue Brown, Director of Academic Services and Acting Coordinator of Accessible Education Services, at 540-375-2247 or by e-mail at sbrown@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Dr. Brown at your earliest convenience to schedule an appointment.