PHYS1425: General Physics I - Mechanics and Thermodynamics

August 20th, 2020

Lecture Sessions:	Tuesday 9:30-10:45am (asynchronized) Thursday 9:30-10:45am (synchronized)	
Instructor:	Xiaochao Zheng	Email: xz5y@virginia.edu
Office Hours:	T 1-2pm, 5-6pm, W 2-4pm (Zoom link on Collab) or by appointment	
Teaching Assistant:	Cameron Cotton	Email: cwc3cg@virginia.edu
TA Office Hours:	T 10am-12pm and W 4-6pm (Zoom link on Collab) or by appointment	
Grader:	Emma Yeats	Email: ery5ua@virginia.edu

Course Goals & Objectives

Why is the highest degree in physics called “Doctor of Philosophy”, not “Doctor of Physics”? How is physics related to philosophy and will learning physics really change how you view the world? As a researcher, teacher, and continuing learner, I truly believe learning physics will change how you view and treat the world. Physics is a science that describes everything around us at the most fundamental level: Why does the sun shine? Why is sky blue? What is heat and what causes it? Can time flow backwards? Physics provides answers to all these questions, and any others you may have about the physical universe. Knowing there is a reason behind everything will help you to face your life differently, because

Nothing in life is to be feared, it is only to be understood

– Marie Curie

This course will get you started in physics. We willl cover mechanics and thermodynamics in this semester. These underlie many of the basic phenomena in everyday life: forces and motion, rotation, equilibrium, energy conservation, oscillations, heat, time, and entropy. You will learn how to apply concepts and physical laws to solve problems. And you will develop problem solving skills that will serve as a foundation for your engineering or other career direction and your place as a rational, positive, and courageous member of our world.

By the end of the course, you will...

- Build a fundamental framework of concepts including forces and motion, energy, motion of solid and fluid, wave and sound, and eventually heat and thermodynamics.
- Develop basic ability of solving physics problems by combining physical laws learned in this course with mathematical methods learned previously.
- Recognize one can use different physical laws to solve the same problem. With some work you will understand why they appear to be different but ultimately give you the same answer.
- Be able to cross check own solutions using multiple methods: estimation, “sanity” check, dimensional analysis, and using different physical laws.

More important, I hope you will (eventually):

- When presented with a challenge, be it a physics problem, an engineering project, or a life crisis, be able to analyze the problem objectively, apply learned knowledge, prioritize, and solve the problem or develop a path to move forward.
- Look at the world around you and realize that there are physical laws behind every pheomenon. Realize how beautiful, grand, yet simple Nature can be. Accept as human beings we are part of this beautiful universe, and be able to draw strength from it no matter what we face.

Course Organization

For Fall 2020 semester, this course will be offered completely online, and will be following the so-called **"flipped" method.**

Each Thursday, I will post on Collab the material to be covered in the following week in the form of **book section reading assignment**. You must complete the reading before Tuesday.

Our Tuesday lectures will be asynchronous. I will post videos prior to Tuesday lecture time to give you some scheduling flexibility to complete the **Tuesday video viewing**. Because you have already completed the reading assignment by Tuesday, in the video I will only review the material and focus on possibly difficult or confusing parts rather than going over all material in detail.

After completing the reading and viewing the video, you must submit a **"minute paper"** by midnight Tuesday, in which you summarize the material of the week that includes the Thursday lecture of the previous week, the reading, and the Tuesday video. The paper should contain new concepts and physical laws, equations, ideas, and any important points you find worth noting. Ideally, you only need this "minute paper" to complete the homework and the quiz of that week rather than flipping through the e-text or the bulky textbook. You may even propose a real-world problem which you think will best test everyone's mastery of the material presented that week. Keep your minute paper organized, as these will eventually form an important part of your learning portfolio. (Note: you may have encountered this type of assignments as "chapter summaries". We will likely blow through more than one chapter per week though, thus we call it "minute paper" here.)

Each week we will have **MasteringPhysics (MP) homework assignments due by 9am Thursday**. While this is an online platform, you are required to submit your written work for each problem to demonstrate how you approach the problem/which physical law was applied, derivations, and numerical calculations when applicable. Your homework grade will consist partly from MP automatic grading and partly from your written work which will be submitted through GradeScope as a separate assignement and reviewed by me or the TA. If you completely miss a problem on MP, submitting written work may allow you to receive partial credits.

Our **Thursday lectures will be synchronized on Zoom**. We will spend 15 minutes to review learning difficulties reflected in that week's homework and/or quizzes from the previous week. We will then **spend 40 minutes on the weekly quizzes**. During this time, the class will be divided into multiple groups (breakout rooms), which each group working together on the quiz problem. **The weekly quiz is due by 5pm each Thursday** because you may need more than 40 minutes to write the full solution. Therefore, I suggest you spend the in-lecture time to develop a basic strategy. You can continue working with your group members after the lecture time, but you must write your solution independently. Your breakout room assignment will be random, and the same group can be considered as your "go to resources" when you continue studying course material and doing homeworks for the following week. The final 15 minutes of the Thursday lecture will be discussions among the whole class on the quiz and Q&A. This arrangement will ensure those with in-person classes either before or after our Thursday lecture to have enough time to commute to their next class.

We will have three exams (two midterms and a non-cumulative final). These will be pledged work and no collaboration and/or outside help will be allowed. These exams will be administered on GradeScope and timed, but with some limited flexibility in timing. Please see Assessment and Grading below for more details.

Textbook and Other Study Material

The **textbook** we will use is **Giancoli's Physics for Scientists and Engineers, 4th edition, with Modifed MasteringPhysics** for completing homework assignments online. The minimum cost is $124.01 at the UVA bookstore or $119.99 directly from Pearson.com for the version titled "Modified MasteringPhysics w/ Pearson eTextbook". Make sure you purchase the correct title as Giancoli has other physics textbooks as well. It will cover both this course and PHYS2415 next semester provided you complete both courses in a 24 month period.

If you relish the feeling of holding and flipping through a bulky physical textbook, you may purchase or rent a hardcopy at the UVA bookstore, Amazon.com, or Pearson.com.

Learning portfolio: Your own weekly minute-paper submissions should form the foundation of your learning portfolio. After completing the homework and the quiz, go back to your minute paper and see if you can add a few more details. Before each exam, put all 4-5 minute papers together and form your own study guide. By the end of the semester, you should have formed your own 2- or 3-page long, comprehensive yet concise study guide that should be sufficient for preparing for the final exam.

Assessments and Grading

The **final grade** for this course will be determined from: 40% Weekly homework assignments (that include the Tuesday "minute paper" and the Thursday MP problem set with written submission), 15% Weekly quizzes, and 15% each from the three exams.

On the Tuesday Minute-Paper Assignments*:* These will be posted as assignments on GradeScope on Collab and are due by midnight each Tuesday. I would assume most people will do this in writing, but formats are also fine. These minute-papers will be graded based on content and the best submissions may be showcased in lecture or distributed as study guides to the whole class.

In addition to summarizing the material, you are welcome to design your own quiz problem. The best quiz ideas will not be showcased, but may be used as real quiz or exam problems.

On Weekly HW Assignments: These are assignments administered on MasteringPhysics. In addition to submitting your answers on MP (and receive automatic grades), you must show your work by submitting your written work for each problem through GradeScope.

On Weekly Quizzes: These are 1 or 2 written problem quizzes that are based on the material you have learned in the previous and the current weesk, and have practiced on by doing the homework assignments on MasteringPhysics. The quiz problems will likely be challenging, and working in groups will likely help. The quiz will be given through GradeScope and will be graded "by hand" by me or the TA.

On the two Midterm Exams*:* These will be open-book and open-note, but pledged exams and will be given online (GradeScope) on the Thursday of the midterm exam week. You must pledge that you have not received or given aid on these exams. We will conduct the exam using a synchronized Zoom session with video on. Accommodations will be made for those who cannot attend the full synchronized session at 9:30am.

On the Final Exam*: T*his will again be open-book, open-note exam on GradeScope and will not be cumulative. That is, the final exam will not test on material that appeared on the two midterms unless if the midterm exams show a substantial percentage of students missing a specific topic. In the latter case, additional problems will be given in the final exam to test those most-missed topics.

Course Policy

attendance policy

Our Tuesday lectures will be asynchronous and "attendance" will be counted in the form of the minute paper. Our Thursday lectures will be synchronous and attendance is counted in the form of the weekly quiz grades. By the end of the semester, those of you who fill out the course evaluation will have the lowest HW grade exempt from the final grading. Additionally, each of you will receive a "free pass" on quizzes which means one of the weekly quizzes is exempt. This should take care of occasional illness or other unexpected "bad week" reasons for missing the HW or quiz. Those of you with low internet connectivity speed may be grouped together to complete the quiz at a different time or asynchronously.

late work policy

This course has a packed schedule. Keeping up your course work – completing your reading, HW and quizzes, for example – on time is really important. For this reason, late work will be graded with a penalty unless if an extension has been granted by the instructor PRIOR to the due date. Please email your instructor (me) in advance if you anticipate difficulties due to unexpected illness, travel, family emergencies. Such extension requests are typically granted. On the other hand, extension requests due to "having too many projects due this week" will be reviewed more carefully on an individual basis.

honor/academic integrity policy

I trust every student in this course to fully comply with all of the provisions of the University's Honor Code. By enrolling in this course, you have agreed to abide by and uphold the Honor System of the University of Virginia, as well as the following policies specific to this course:

– You may collaborate on the weekly homework assignments, but each one of you must submit your solution independently. Copying solutions from online "study helper (aka cheater)" websites or posting assignment problems from this course to such websites are both violation of the honor policy.

– You will work in groups on the weekly quizzes, but each of you must write and submit your solution independently. Copying others' solutions is a violation of the honor policy.

– You must complete your Tuesday minute paper independently.

– You must not give or receive any help on the midterm and the final exams.

Let me tell you what I think about academic integrity: honor offense of any kind or scale hurts the whole class. More important, I do not think I need to remind everyone how difficult it is to take courses and pursue your education under the current pandemic situation: It takes longer to view the video or read the book, it's harder to focus and understand what the book says when you are living with your family or peers, and it takes longer to complete the homework, alone in your dorm or apartment. So why are we doing this and what do we get in return? The answer is simple: knowledge, and value of such knowledge, which can be learned only by hard and honest work. If we can manage to get through this course, complete all assignment and exams, we will emerge as a stronger class than those who didn't work as hard and we will be able to pat our back and say: "That was hard but we did it!"

Accessibility

There are plenty of opportunties should you wish to discuss course material or problem sets with me: we will have built-in Q&A time every Thursday during our synchronized lecture. The weekly quiz time serves also as a Q&A time, and some of you may find it easier to ask questions in the smaller breakout room (than in the full-class session). Office hours are offered every week on Zoom (exact time will be announced later). If you wish to meet at a different time and/or for one-on-one consultation, let me know and I can set up a separate Zoom session. The Piazza function is available on Collab though I have no experience with it, so I can use some help learning how to use this platform (and answer questions there?). Finally, email inquires are always replied within 24 hours and often more promptly (within reasonable hours) if it's about the homework that is due soon. In summary, I wish I can be there whenever you need me, and please let me know how I can help.

Special Accommodations

There is no doubt the ongoing pandemic is posing great difficulty to everyone's life, and perhaps more so for some than others. If you are facing difficulties, whether it is slow internet connection, different time zone, having to work at fixed hours, of if you anticipate any issue related to the format, material, or requirement of this course, please do not hesitate to contact (email) me and we can explore potential options without lowering quality of teaching and learning.

Students with disabilities may wish to work with the Student Disability Access Center (SDAC) to discuss a range of options to remove barriers of learning, including official accommodations. Please visit their website for information on this process and to apply for services online: sdac.studenthealth.virginia.edu. If you have already been approved for accommodations through SDAC, please send me your accommodation letter and/or meet with me so we can evelop an implementation plan together. If you are in the process of evaluation, please let me know as well and I may grant accommodations prior to an official letter is issued.

Other Thoughts

In this age and year, there are hundreds of videos online that one can use to learn even the simplest or the most bazzar subject. You may wonder, then, what does this course offer that you can't find elsewhere? Can't we just send everyone to a series of online websites to learn? This is a tough question to answer, and I didn't really know how to approach the question so I enlisted a helper, my oldest son who is going to an all-virtual 7th grade. He told me that, he isn't sure if he has really learned something unless if there is a teacher to guide him and give him work to do and tests to complete. And of course, he misses the school setting. As your instructor, I can't give you a in-person setting under the current circumstance. Besides, large classes are awfully difficult to teach in person. However, I am confident that you will learn the course material if you watch all videos, read the book, complete the assignments and quizzes. This is particularly true if you have to "show your work" on a piece of paper and scan and submit it. For this reason, do not take your homework assignment lightly and do show your best work in the written submissions. I hope, by using breakout rooms for a smaller group settings, that I can give you back 5% of the in-person experienece, and that you still get to know a few new friends from this course and learn together, and get through this semester together.

Class Calendar

Date	Minute-paper due	Tuesday Lecture (asynchronous)	HW due	Date	Thursday Lecture (synchronous)
	internet survey		HW0 (ungraded)	8/20/2020	Zoom Practice Session (optional)
8/25/2020	#1	Does your number make sense?	HW1	8/27/2020	Quiz 1
9/1/2020	#2	Vectors, 2D and 3D motion	HW2	9/3/2020	Quiz 2
9/8/2020	#3	Newton's laws, your high school physics revisited	HW3	9/10/2020	Quiz 3
9/15/2020	#4	Newton's apple (gravity)	HW4	9/17/2020	Quiz 4
9/22/2020	#5	Unit 1 review, then Work and Energy		9/24/2020	midterm1 (pledged)
9/29/2020		My two boys are trying to invent a perpetual engine. Can you help please?	HW5	10/1/2020	Quiz 5
10/6/2020	#6	So how do you push that asteroid away? – momentum and momentum conservation	HW6	10/8/2020	Quiz 6
10/13/2020	#7	Rotational motion and angular momentum	HW7	10/15/2020	Quiz 7
10/20/2020	#8	Unit 2 review, examples		10/22/2020	midterm2 (pledged)
10/27/2020		Engineering disasters of the world (static equilibrium)	HW8	10/29/2020	Quiz 8
11/3/2020	#9	Playground swings and violins (oscillation)	HW9	11/5/2020	Quiz 9
11/10/2020	#10	Hot air balloons (ideal gas law)	HW10	11/12/2020	Quiz 10
11/17/2020	#11	Heat is energy, so why can't we use it to propel motion? (kinetic theory)	HW11	11/19/2020	Quiz 11
11/24/2020	#12	laws of thermodynamics		11/26/2020	No lecture, Happy Thanksgiving!
12/1/2020		Can time flow backwards?	HW12	12/3/2020	Quiz 12
12/8/2020	#13	Course summary, snow catchup			
Final Exam		Final Exam (pledged)			