University Physics - I

Fall 2020

Instructor:	Shaon Ghosh	**Time:**	M/Th 14:15 – 15:30
Email:	ghohsh@montclair.edu	**Place:**	Zoom & Richardson Hall

Course Pages:

1. Official Course page: https://montclair.instructure.com/courses/130755
2. Slack Channel for discussions: https://physics-at-montclair.slack.com/archives/C0171KGK70W. Send me an email from your montclair.edu email ID with request to join so that I can add you.

Office Hours (Zoom):

- Monday 1:00 PM - 2:00 PM
- Monday 3:30 PM - 4:30 PM
- Friday 3:00 PM - 5:00 PM

Main References:

- Randall D. Knight, *Physics for Scientists and Engineers a Strategic Approach*, Pearson, 4th Edition. (Text book)
- David Halliday, Robert Resnick, and Jearl Walker *Fundamentals of Physics Extended*, Wiley, 10th Edition. (Reference)

Description of the course: University Physics I (aka PHYS 191), is among the foundational courses of Physics. The material that we will cover in this course will be very similar to what you may have encountered in PHYS 193 (or similar course), the main distinction being the application of calculus to develop our understanding. In this course, we will be studying

1. The concepts of motion and kinematics
2. Dynamics and the laws of motion
3. Work, energy, and conservation of energy
4. Friction
5. Momentum, and its conservation
6. The motion of rotating objects, and angular momentum
7. Gravitation.

Calculus is the backbone of science. Whether we want to be a scientist, an engineer, a doctor, a science teacher, or any other technical field related to STEM studies you can think of, our science education is not complete until we learn calculus based treatment of nature. The tools of calculus that you are learning, or have learned, in your math class, were in fact developed to understand the physical reality of nature. In this course you will see how many of the formulae in physics can be derived using calculus that you memorized without knowing why they work.

The goal of this course is, however, more ambitious. Merely reproducing the results derived by the mathematicians centuries ago is not our only aim. Of course, we will learn that, but the goal is to train you to wield this incredibly powerful tool so that, just like the great mathematicians of the past, we too can solve real-life problems using calculus. So, a part of this course will be on applying these tools of calculus to solve problems and then checking them numerically to see if the results indeed agree. We will be using computer programming in Python for that purpose. Some of you might not be familiar with Python, which is understandable. Hence, part of the course will be dedicated to bringing you up to speed in that. Details of the computational methods you will be learning in this course:

1. Python programming language basics that are required for this course.
2. Numerical differentiation
3. Numerical integration using the Trapezoidal rule, and Simpson's rule
4. Numerical root-solving using bisection method, and Newton-Raphson method.
5. Numerical solution of very simple linear differential equations (relevant to the course).
6. Reading of data from files and incorporating data into the solving problems.
7. Visualization of results using plots, making animations of simulated results.

Prerequisites: Good understanding of algebra and trigonometry, basic knowledge of calculus.

Evaluation components:

- **Assignments:**
    1. Home-works: Homework is the most essential part of this course. You cannot learn physics without doing numerous problems. Most Home-works will be assigned through Canvas. Occasionally I might assign Home-works that requires you to show your work, which may or may not be assigned via Canvas. Expect homework to be assigned on an average at least once per week. However, this may change depending upon the situation.
    2. Reading quizzes: In addition to regular problem sets (which are usually quite lengthy and may take many hours to complete), you will also have reading quizzes due before the start of lecture. You can expect at least one of these per week or two. Their purpose is to encourage you to read the chapter and begin thinking about the material before the lecture. They usually take between 10 and 30 minutes to complete. You are expected to keep track of the reading quizzes. These will not be announced ahead of time, and you can expect them to be sometimes posted only 24 hours ahead of the lecture.
    3. Pop quizzes: You can expect 3 to 5 pop quizzes at unannounced times during the semester. These will typically be 10 - 15 minutes long and will review recently covered material. The lowest quiz grade will be dropped. Sometimes I will group all of you during these quizzes in breakout-rooms on Zoom. You can discuss with your group-members to solve the questions. On other occasions I might assign the problems to you individually, and you will have to solve them on your own. The submission of the quiz will be on Canvas. You need to pay close attention to the time constraint, since Canvas will not grade your quiz if you submit late.

The lowest two homework scores will be dropped from your final grades calculation. The lowest reading quiz and the lowest pop-quiz will be dropped. So, a total of 4 assignments will be dropped in all. This is to protect you against occasional slip-ups or poor-performances.

- **Numerical programming:** Apart from the aforementioned assignments, there will be many numerical assignments during the course that will require you to use computer programming to solve. You can take help from your classmates to solve these problems. But you need to submit your own work. They are all going to be extra credits, so if you do not submit them it will not hurt your score. But, you can use this to your advantage to improve your grades, and in turn learn something exciting and new. Moreover, there will be a course project due at the end of the semester, that will require you to do some programming. So, this is a good opportunity to learn programming before you start working on the project. More on this later.

- **Course Project Report & Presentation:** You will have to work on a project in this course. The project will be a computational problem where you will have to write a computer program to solve some physics problem. You will be working on that in groups of 3-4 students. I will set these groups up in such a way that each group has at least one individual who has prior experience in computer programming before. The goal is that those who have no exposure to computer programming before can learn about coding from their peers, and those who have learned computer programming already, can use this skill to solve some science problems. The project report will have to submitted by each of you individually. I will be covering some aspects of programming in Python for the lectures. For this it is important that you have Python installed in your computer or at least have access to some computer with Python. You are welcome to use any other programming language, just that the examples I will show in class will be in Python. The Python programming language is very easy to learn. One can pick up the basics (if they have Python installed in their computer) and he core of the language by working on it for a week or two. The project report will be due at the end of the semester. The project topics will be created later in the semester.

- **Exams:** There will be three exams for this course, two midterms, and one final exam. All exams will be open book, but you are not allowed to access web resources during the exams. It is also not to your benefit to search web-based resources, because I will compose every single problem myself. If you find a "similar sounding" problem in in internet, please note that will be a pure accident, and chances are that the problem will not be exactly same. You are more likely get the wrong answer if you copy the answer from the web. You will be using Lock-down Browser on Canvas to take the exams. Midterms will be based on the material covered before that midterm and after the previous midterm. Final exam will be based everything taught during the semester. However, about 80% of the problems will be from topic covered after the second midterm.

Grading Policy:

- Home-works = 10%
- Reading assignments = 10%
- Pop-quizzes = 10%
- 1st mid-term = 10%
- 2nd mid-term = 10%
- Lab = 15%
- Final exam = 15%
- Project = 10%

- Class participation = 10%
- Numerical programming assignments = Extra credits.

Important Dates:

Midterm #1	TBD
Midterm #2	TBD
Final Exam	December 14, 2020

Course policy and expectation:

1. Attendance at every lecture is not required but will be encouraged via pop quizzes and class-participation points. Attendance at labs and tests is mandatory. Kindly arrive for lecture or lab on time.
2. Be prepared for class. Text readings should be completed before class to maximize understanding. Any assigned reading quizzes should be completed before the start of class. You should also read the relevant laboratory handout (if given) in advance. Please print out the lab for each week and bring it with you to your lab section. Labs and other assignments will not be accepted unless they are stapled. It is recommended that you purchase an inexpensive mini-stapler and keep it in your book bag (see, e.g., http://www.amazon.com/dp/B008DQY6J4).
3. You should bring pens, pencil, blank paper (in addition to your notebook), and a calculator (phone-based is ok) to the lab. A calculator with basic scientific functions is preferable (trig functions, logs, roots, exponentials). No calculators/phones/computers/tablets may be used on exams, so you should familiarize yourself with performing basic calculations with only pen and paper.
4. Laptop/phone use: To avoid distracting the instructor, your fellow students, and yourself, the use of laptops, phones, or tablets is not permitted during the lab (except when explicitly stated by the instructor). Please be sure your devices are set to "off" or "silent".
5. The lectures will be recorded and and the recording will be linked in the Canvas page. However, the course materials (including the recordings and your own assignments) should not be posted online or shared with students in subsequent years.
6. Students are expected to follow all MSU policies regarding harassment, bullying, plagiarism, and computer usage. Everyone in this course will treat everyone else with respect.
7. Collaboration policy: you can discuss homework problems with your classmates, but you must understand and complete the assignment independently (e.g., your friend should not tell you what answer to enter nor should you "google it" or use any other dishonest means to advance your grade). A complete understanding of the homework problems will dramatically improve your performance on exams. Labs will be worked on in groups, but the write-ups must be completed independently (you can ask your lab-mates for clarification on points you don't understand).
8. Plagiarism, cheating, or any form of academic dishonesty will not be tolerated and could result in a zero for an assignment or an F for the course, as well as a referral to the Dean of Students. Examples of academic dishonesty include: submitting a homework response that is not based on your personal understanding of a problem; copying lab report answers from your lab partners; lifting portions of a written report from Wikipedia or another source without proper citation.
9. The majority of class participation credit (aside from attendance) will be assigned generously based on compliance with the above policies and on how one positively contributes to class discussions.

10. Reasonable accommodations for students with a documented disability can be arranged by visiting the Disability Resource Center (DRC, Morehead Hall 305) and requesting an accommodation letter. This letter should be supplied to me during the first two weeks of class.

11. This class will not be easy. You should expect to spend at least 6 hours outside of class per week reading the textbook, working on problem sets, and completing lab reports. While this class is difficult, you do have the ability to reach competency in the material if you are willing to invest the necessary amount of time. I am here to help you. I want you to do well. Please come to my office hours if you are having difficulty.

Etiquette's for online classes:

1. Please use your actual name (the name you used to register in this course) for your Zoom participant name. You can view what your participant name is on Zoom by clicking on the "participants" button at the bottom. It will pop-up a participants list on the right side of your Zoom window, with your name at the top of the list. If your name is automatically chosen by Zoom, and you want to change it to what is your registered name in the class, you can do that by right-clicking and then renaming it. This is important since Zoom automatically takes attendance, which will be used for your class participation score, and for your scholarship requirement.

2. The classes will be synchronous-online, which means I will be physically present in front of my computer to give lectures. The benefit of that is that I can answer your questions and engage in a discussion during the class. To make sure this is done properly we need to all use webcams to transmit out videos. I can then see your faces which will really help me to assess each of your understanding of the topic.

3. When you are not speaking please make sure to mute your mic. This helps in avoiding stray noise from your background and also stops feedback of your own speaker's sound to your mic.

4. Zoom has a feature for hand-up. This allows the participants to alert the speaker (me) that there is a question. Please use that feature first. Sometimes I might not be able to see it, especially if I am in a presentation mode. In that case please do not hesitate to speak up. We will try to simulate the environment as close as possible to a traditional lecture. I will also ask for volunteers among you during the class to monitor hand-ups and alert me.