

ELECTRICITY AND MAGNETISM

Spring 2021

Instructor: Shaon Ghosh	Time: M/Th 12:45 – 14:00
Email: ghohsh@montclair.edu	Place: Zoom

Course links:

1. Official Course page: <https://montclair.instructure.com/courses/137994>
2. [Zoom link](#).

Office Hours (Zoom):

- Monday 2:15 pm - 3:15 pm
- Thursday 2:15 pm - 3:15 pm
- Outside office hours meeting set-up via emails.

Main References:

- David J. Griffiths, *Introduction to Electrodynamics 4th Edition*, Cambridge University Press, 4th Edition. (Text book)
- Murray Spiegel, Seymour Lipschutz, and Dennis Spellman, *Vector Analysis*, McGraw Hill.

Description of the course: In PHYS 340 we will be advancing our understanding of the concepts of electricity and magnetism. Most of you have had your first encounter with this subject in your PHYS 192. It is very important that you review the concepts of electrostatics, electric potential, magnetism before we get into the main topics of this subject. The study of electricity and magnetism requires a good knowledge of vector analysis. Vector analysis includes vector algebra, which all of you are familiar with by now, and vector calculus. I will be covering some aspects of these mathematics in the class, however, it will not be a full treatment, and will focus on only the aspects of vector analysis that are required for this course. I have listed an excellent text book on this subject above which you all should buy and study on the side. This book has numerous solved examples. The best way to learn is to first read the chapters (which are generally very short) and work out the solved examples yourself, looking into it if you get stuck.

In this course, we will be studying the following topics (generally in the order presented below)

1. Electrostatics
2. Electric Potentials
3. Magnetostatics
4. Electrodynamics
5. Electric and magnetic field in matter

One of the most important things to learn in PHYS 340 are the various techniques of solving differential equations. You will soon realize that there are certain symmetry between electricity and magnetism and once you have learned one, the concepts can very easily be transferred to the other. So, I will spend more time to carefully develop the understanding of these methods in the first part of the semester.

Prerequisites: Solid understanding of calculus is very important. I will be assuming that because you all have taken PHYS 210, you have already gotten a taste of what level of calculus is expected from students of physics. If you struggled with calculus in PHYS 210, then please pay extra care in reviewing it. I will be happy to discuss your doubts and confusions.

Concepts of vectors should be crystal clear in your mind. It will be very difficult if rudimentary concepts like dot products, cross products, etc are still alien to you. It is not expected that you will know everything about vector calculus, which I will partly cover, but you should be familiar with it. You will have to also get used to coordinate systems other than Cartesian. In fact you will find due to the symmetries of electromagnetic forces, most analysis will be predominantly done in polar, cylindrical polar, or spherical polar coordinate. You should be able to easily transform from one to other. These will initially be not easy, but with practice you will get good at it.

Finally, you will need to practice solving ODEs. I will teach you how to solve PDEs, but some knowledge of the techniques of solving ODEs are essential. If you have trouble with these, please meet me during the office hours.

Evaluation components:

- **Assignments:**

1. **Homeworks:** Homeworks will be assigned roughly once every two weeks. However, it may depend on the pace at which we are covering the material. Homework will be assigned on canvas, and you will need to submit it there. Often homework will be assigned on topics that I will be covering during that week. However, you do not need to wait for me to finish all the topic. A subset of questions you might already be able to solve when make the homework available. You should feel free to start solving them, and save time. Homework problems are supposed to be testing your in-depth knowledge of the subject.
2. **Quizzes:** Quizzes are in class component of this course. The questions during a quiz are going to be more conceptual and not something that will require you to do long calculations. Sometimes I will assign reading before the class and then the quiz will be based on that reading. Sometimes I will be announcing the quiz in advance, other times they might be held without notice. This is to make sure that you are also preparing yourself on the side. There will be two types of quizzes, one where you will be taking the quizzes on your own, and then on some occasions you will be taking the quizzes in groups. This is true for both announced or unannounced quizzes. You should be expecting a quiz roughly every week.

The lowest two homework scores and two quizzes will be dropped from your final grades calculation. This is to protect you against occasional poor-performances, or if you are not able to make it to the class.

- **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. You will be using Lock-down Browser on Canvas to take the exams. **You will also need to have your webcam on during the exam.** So, please make sure you have a webcam, otherwise you will not be able to take the exam. Talk to me if you do not have a webcam, and we arrange one. 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. Barring extenuating and documented circumstances there will be no opportunity to retake the exam or to take it on another day. So, please make sure not to miss the exam.

- **Class participation:** Class participation is an important component for this course. It constitutes 15% of the grade, which as you can see, is as high as all the other individual components except the final exam. Multiple factors will be included in the class participation. Firstly, your attendance will be taken into consideration. I will use Zoom report to verify your attendance in the class. However, it is not possible for me to ascertain if you are actually present in front of the computer or not during the class if you do not keep your webcam on. So, I will follow the following strategy: those who have their webcam on, will get automatic score for your attendance. Those who do not have their webcam on will not automatically lose the attendance, however they can potentially lose the attendance points if I ask them a question during the class and they fail to respond. I will also systematically ask them more questions as well, since I am generally more worried about the students I do not see. The second aspect of in-class participation is going to be based on how well you interact in the class during the discussions. Please note that you do not have to always give the right answer to get points for that. Giving a wrong answer is better than giving no answer in this case. Furthermore during the quizzes I will pay attention how well you are interacting with your other group members. Finally, I will give you points for your general overall involvement in the course, and your compliance with the course policy (see below).
- **Extra credits:** There will be opportunities to score extra credits. This can boost your grade in the class, or help you compensate for missed assignments. Large fraction of extra-credit problems will involve some computational aspect.

Grading Policy:

- Homeworks = 15%
- Quizzes = 15%
- 1st mid-term = 15%
- 2nd mid-term = 15%
- Final exam = 25%
- Class participation = 15%
- Extra credits.

Important Dates:

Midterm #1	TBD
Midterm #2	TBD
Final Exam	May 21, 2021

Course policy and expectation:

1. Attendance at every lecture is not required but will be encouraged via pop quizzes and class-participation points. Kindly arrive for lecture on time.
2. Be prepared for class. Text readings if they are assigned should be completed before class to maximize understanding.
3. 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.

4. 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.
5. 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; lifting portions of a written report from Wikipedia or another source without proper citation. During exams it is very important that you follow these very carefully, because these rules will be most stringently enforced there.
6. Class participation credit (aside from attendance and engagement in discussions) will be assigned generously based on compliance with the above policies.
7. 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.
8. Late submissions of homeworks will result in 10% deduction of your overall score per day. You do not need to ask me to allow you to submit late, Canvas should allow late submission.

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.
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. On some occasions I will be posting async lectures for you, especially when something requires tedious calculations. This saves a lot of time during the lecture, and I have found that the students also generally appreciate to see the long calculations at their own pace.
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.